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(54) **RETAINING MECHANISMS FOR TROCAR ASSEMBLIES**

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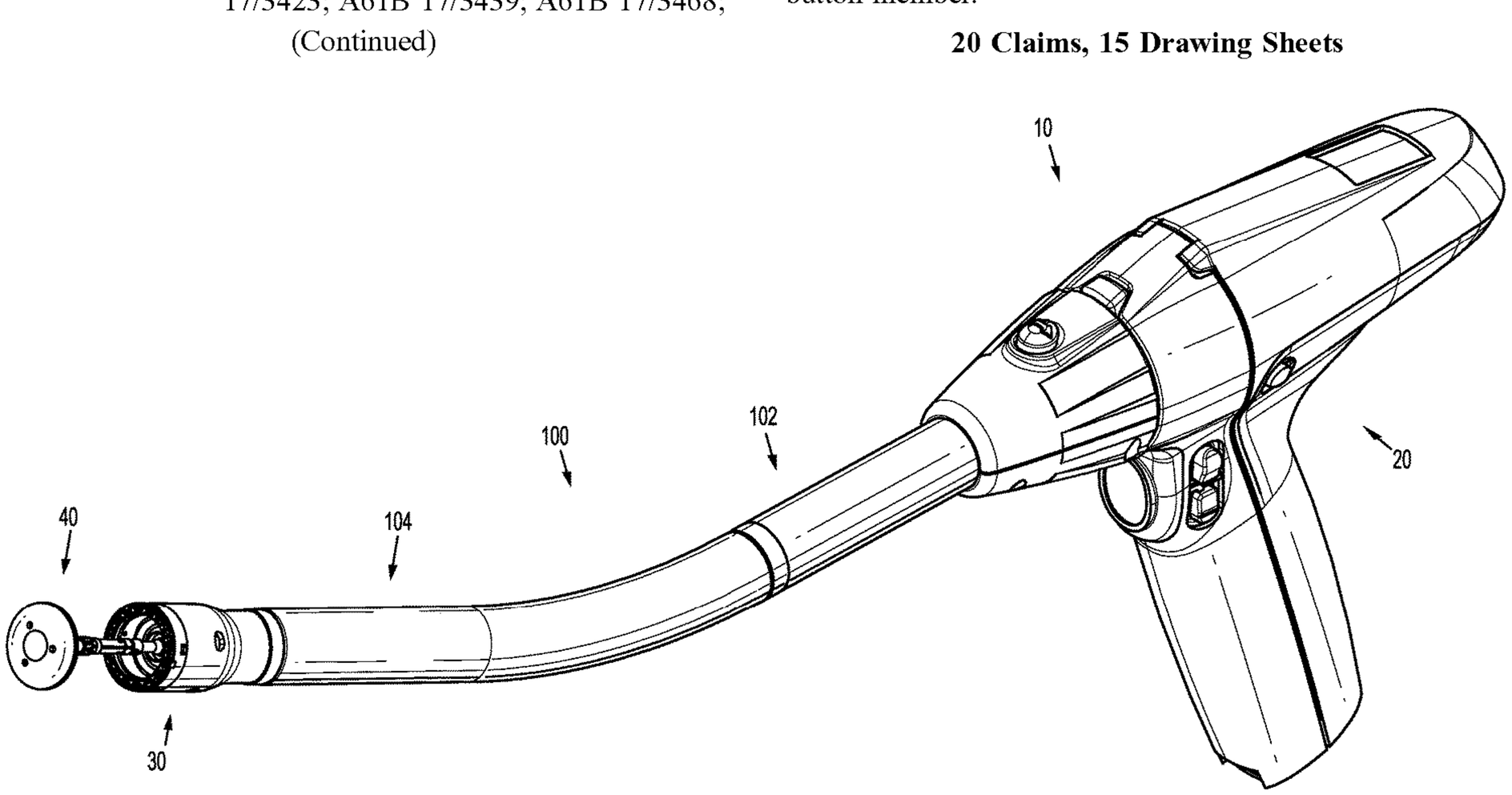
(57) **ABSTRACT**

An adapter assembly includes a sleeve, a trocar assembly releasably securable within the sleeve, and a retaining mechanism configured to releasably secure the trocar assembly within the sleeve. The retaining mechanism includes a retaining block, a cam wire moveably positioned relative to the retaining block between a lock position and a release position, a retaining block extension for maintaining the cam wire relative to the retaining block, a button member in operable engagement with the cam wire, and a pair of retaining members. The button member includes a center beam moveable from an unflexed position in engagement with a stop tab of the retaining block extension to prevent movement of the button member to a flexed position out of alignment with the stop tab to permit movement of the button member.

20 Claims, 15 Drawing Sheets



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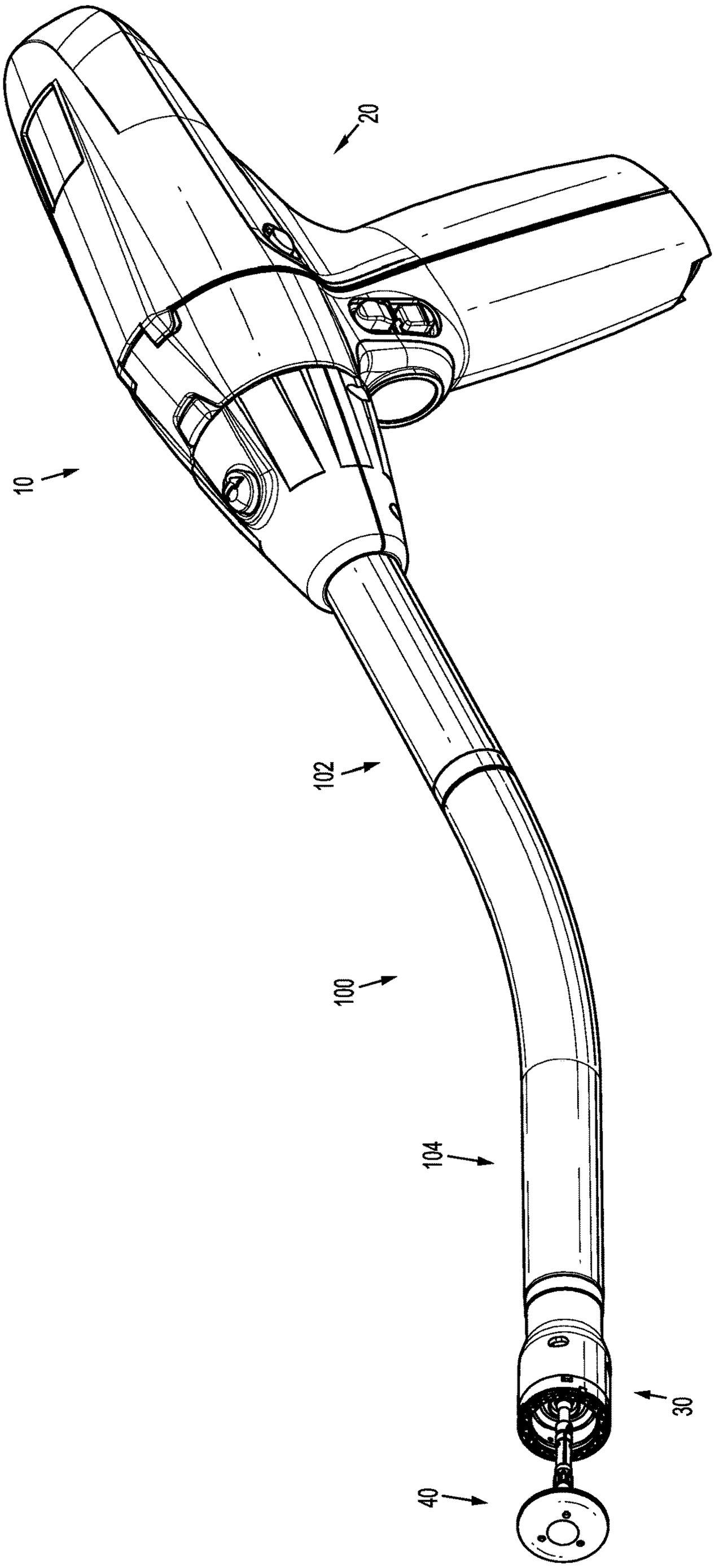


FIG. 1

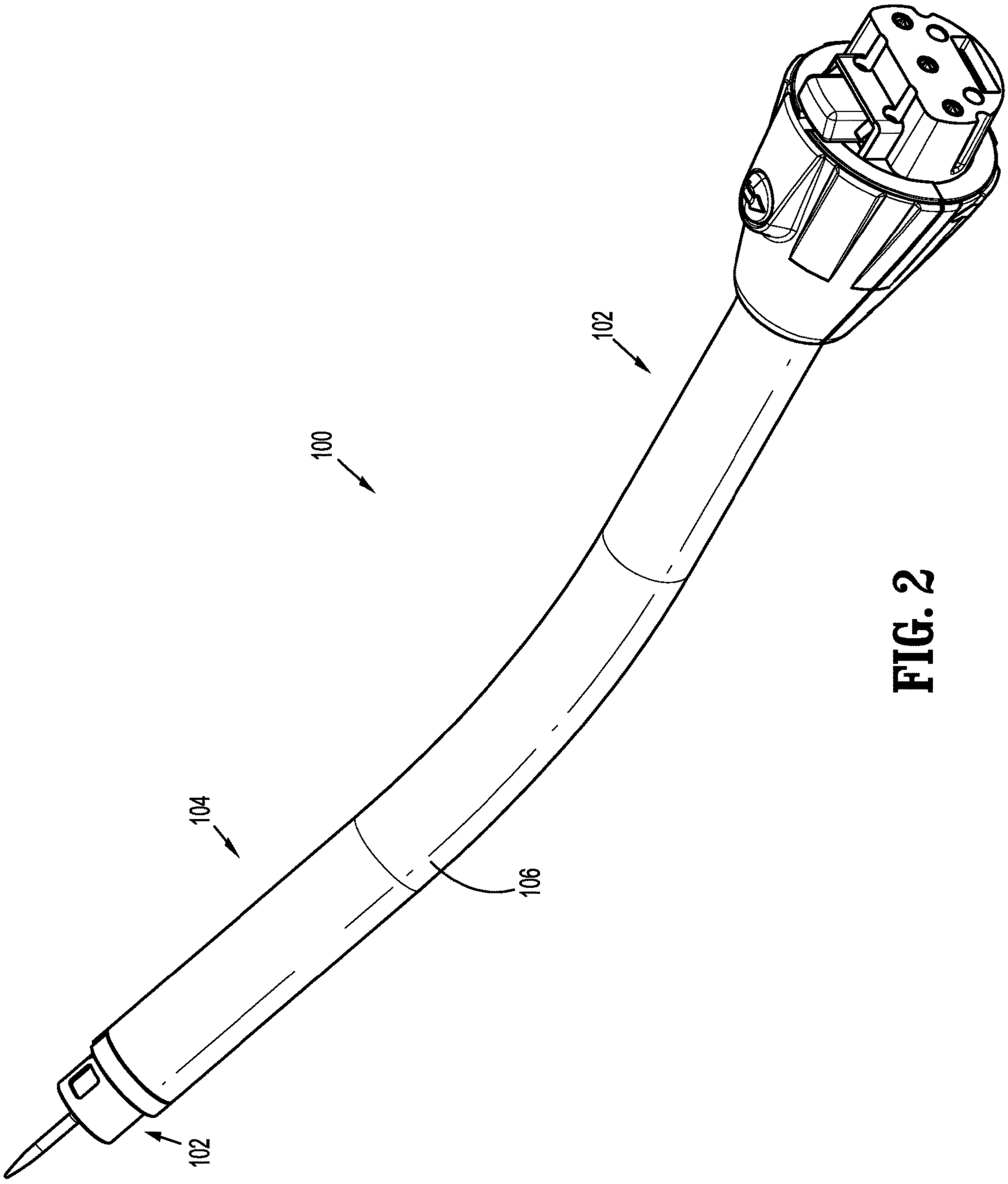


FIG. 2

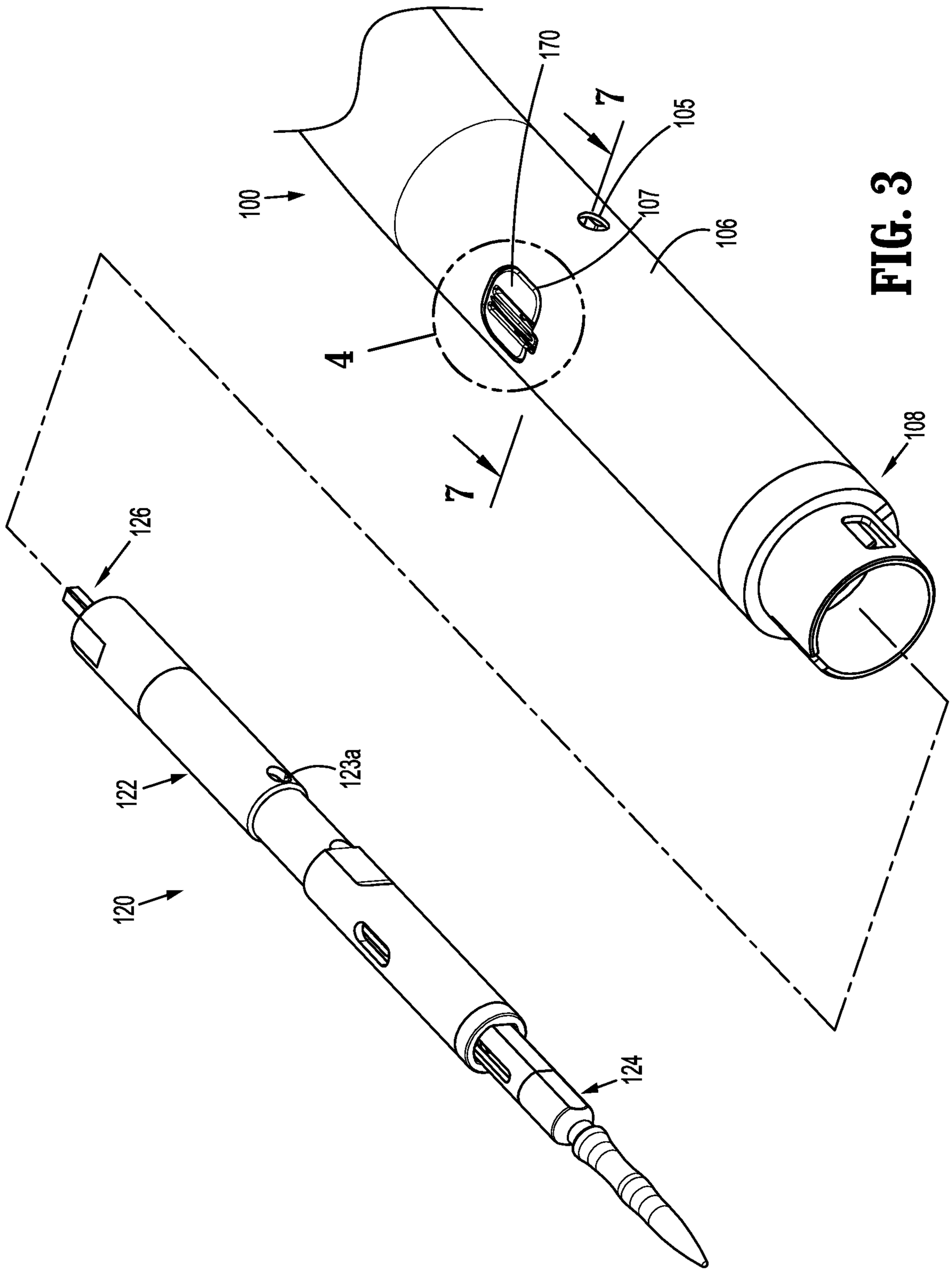
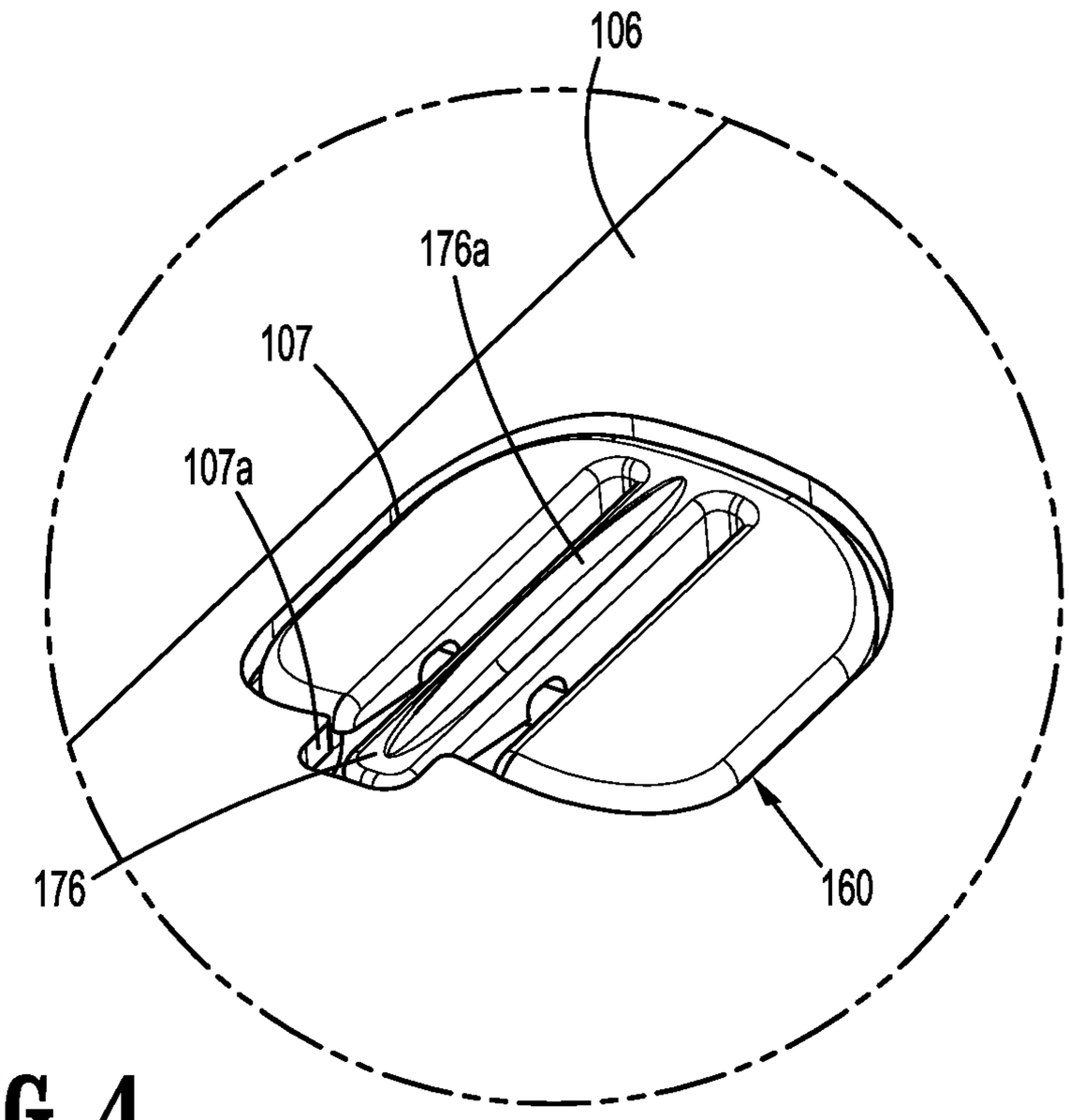


FIG. 3



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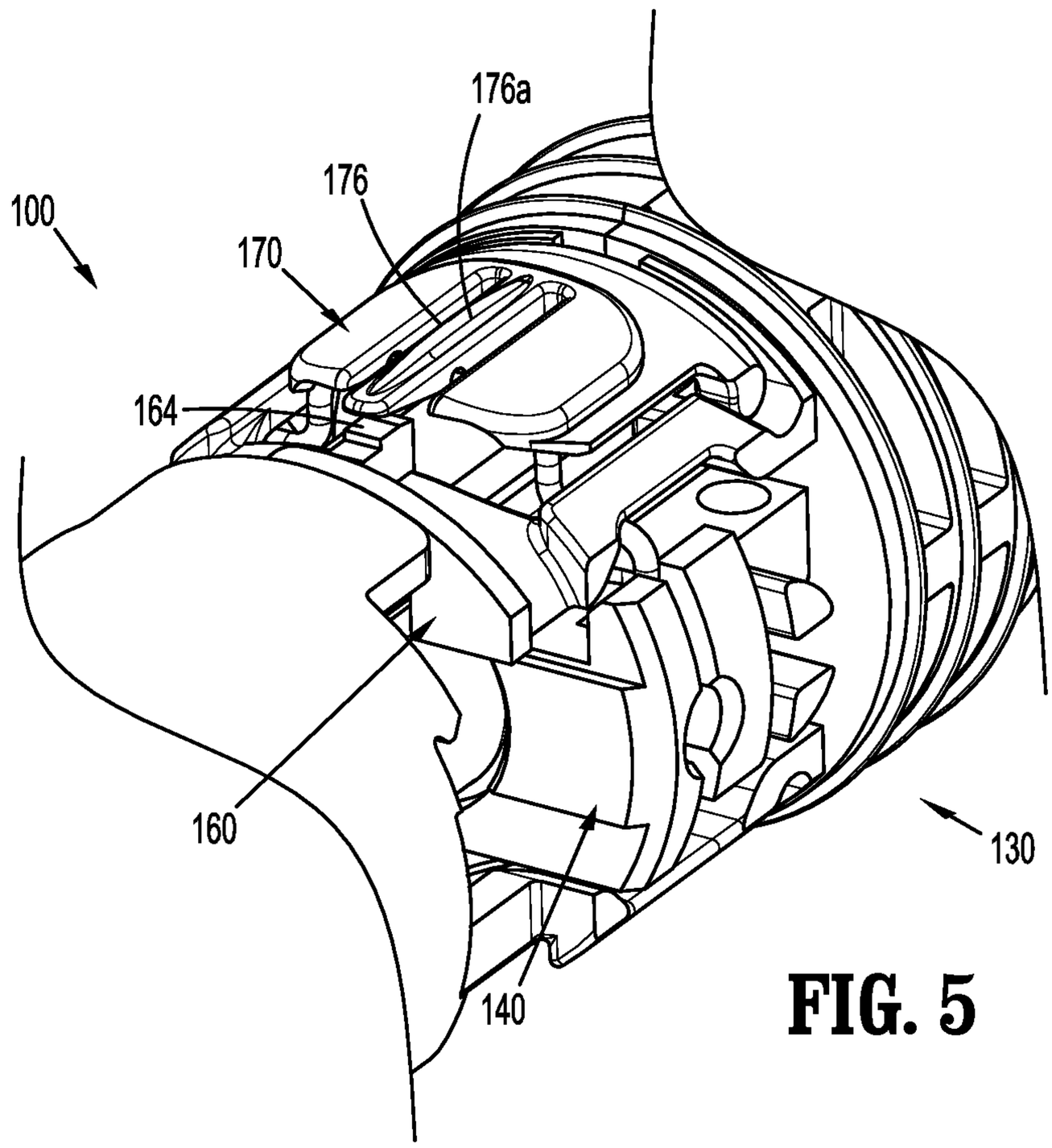
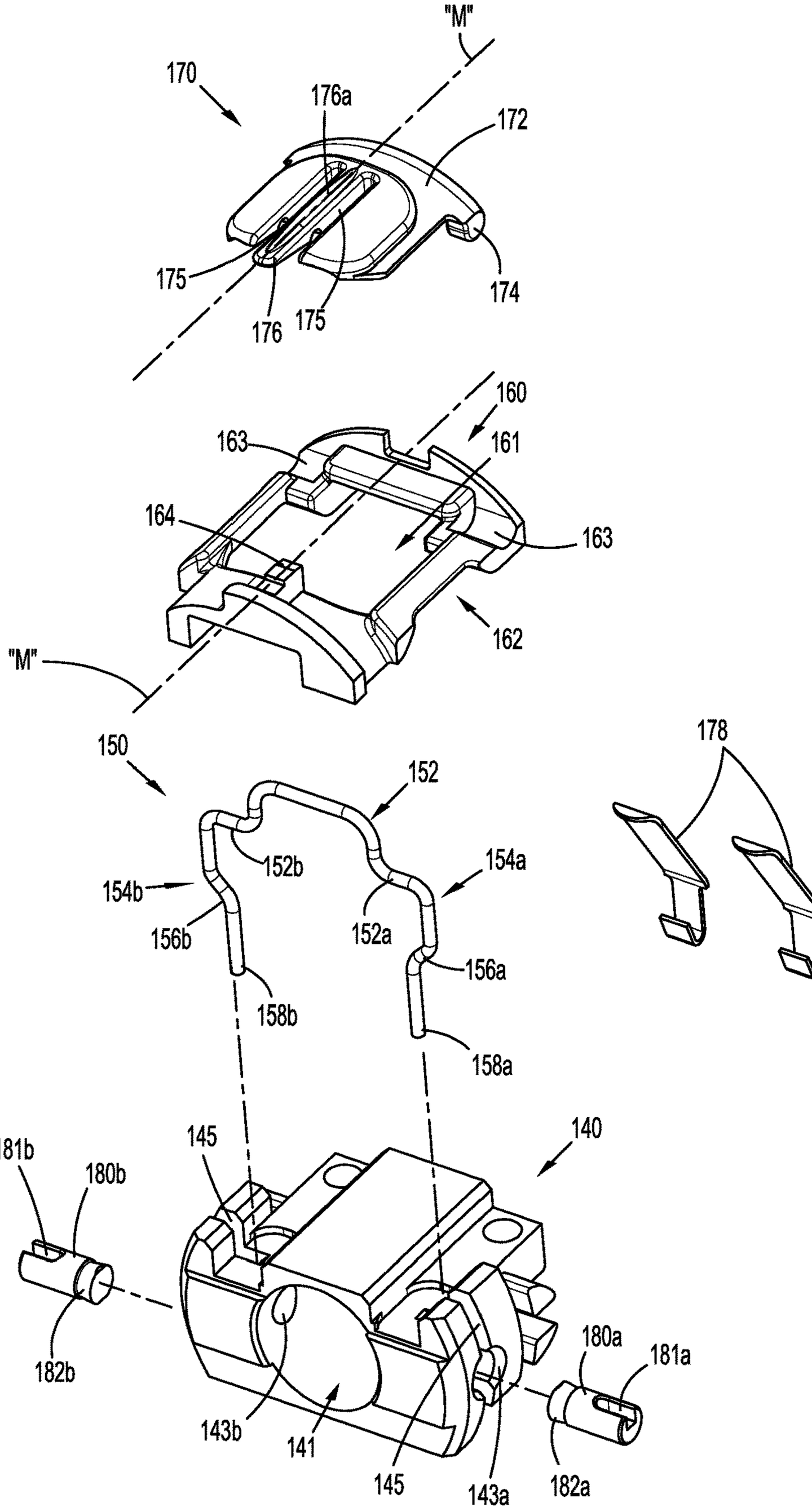


FIG. 5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175
174
176
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160
161
163
164
163
162
"M"
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152b
154a
154b
156b
152a
156a
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181b
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141
145
143a
180a
181a
182a

FIG. 6

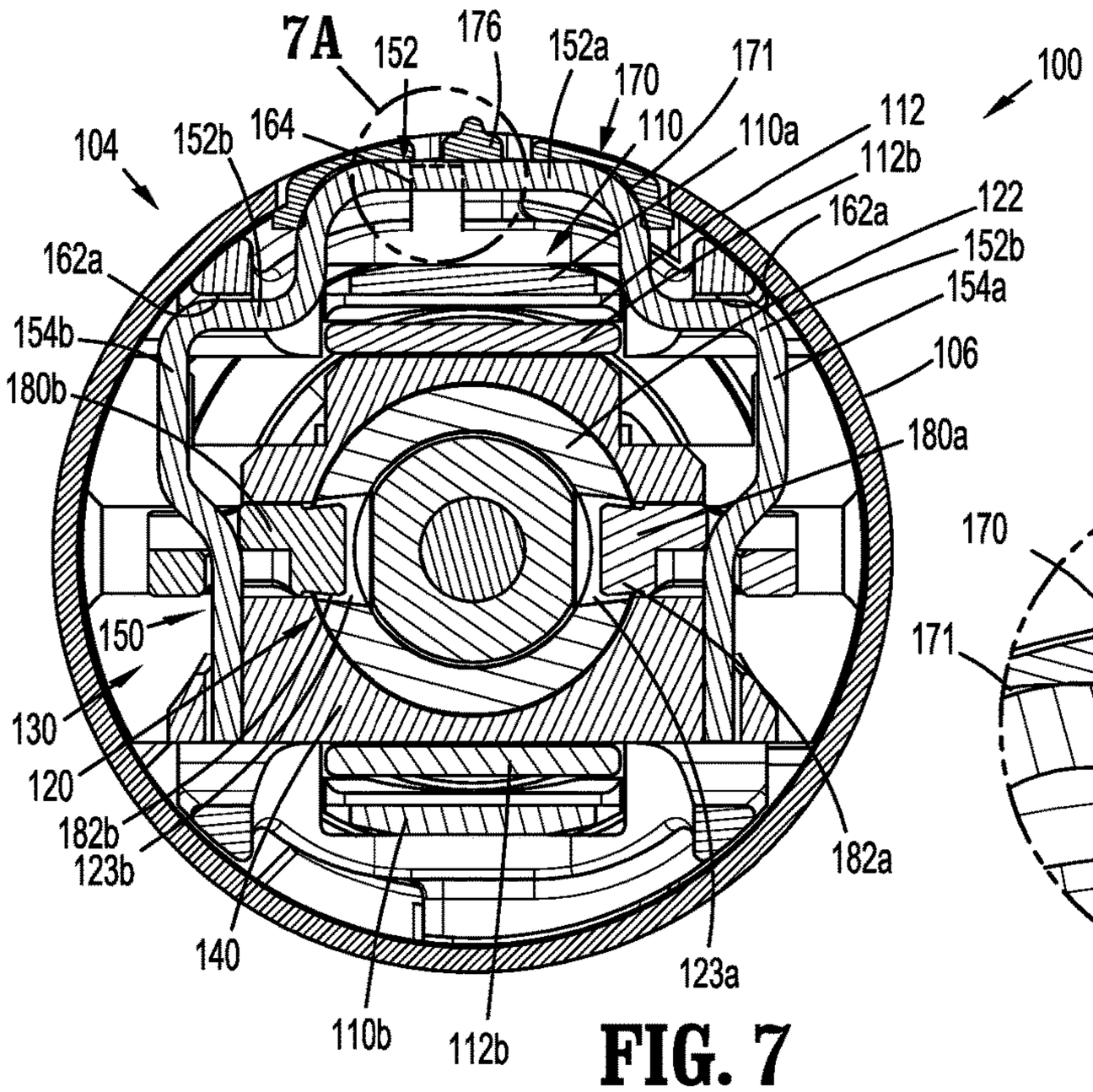


FIG. 7

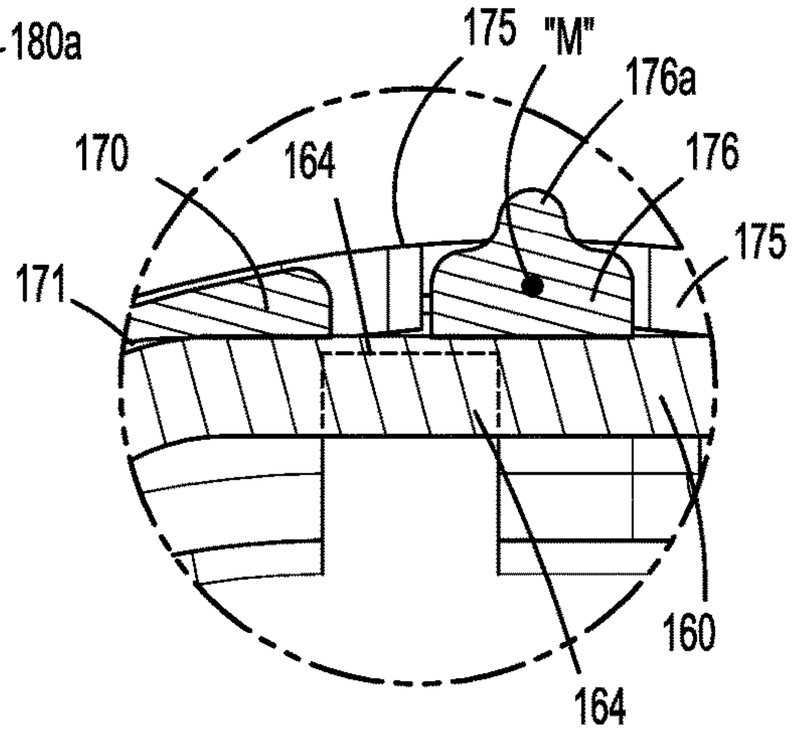
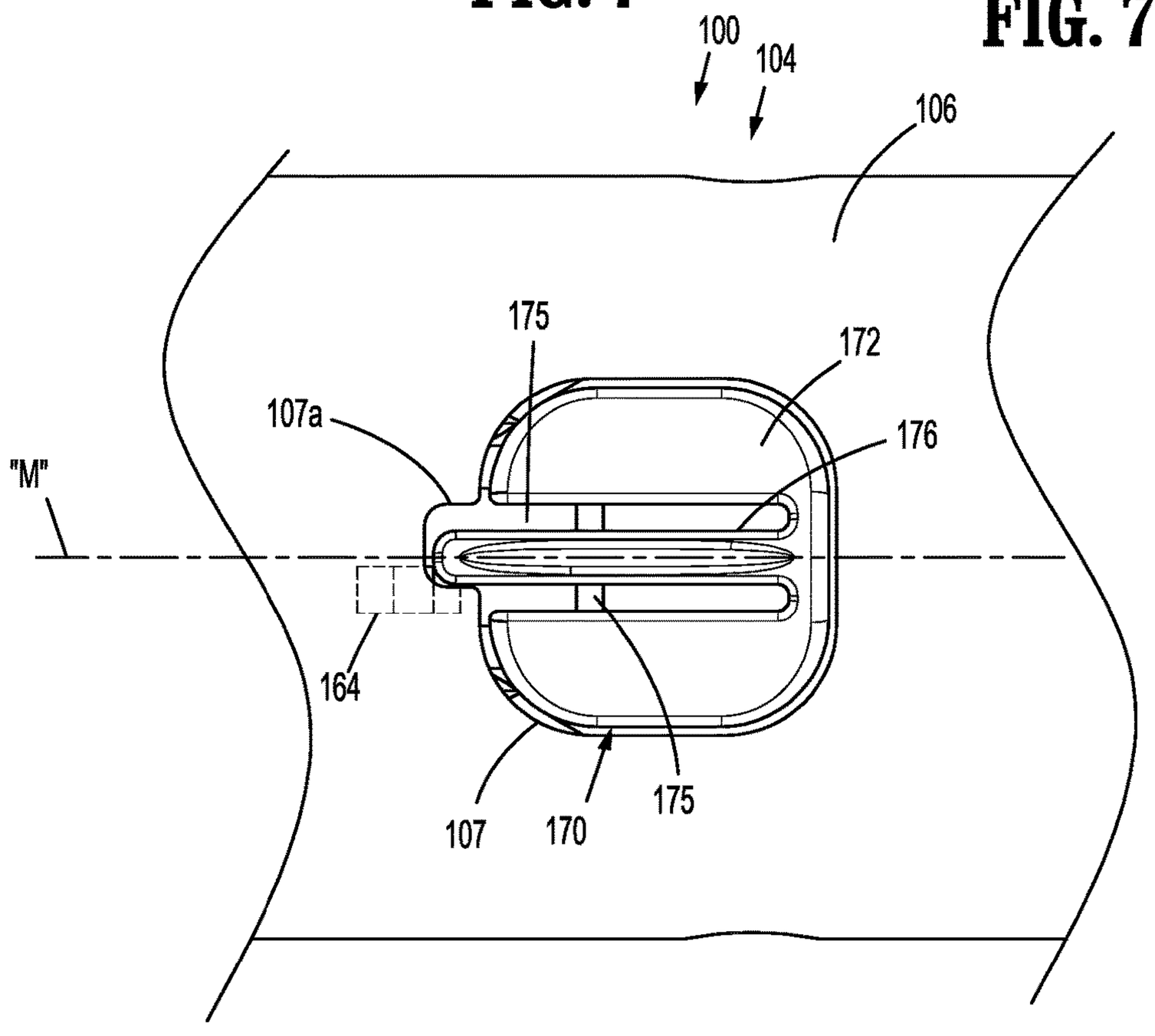


FIG. 7A



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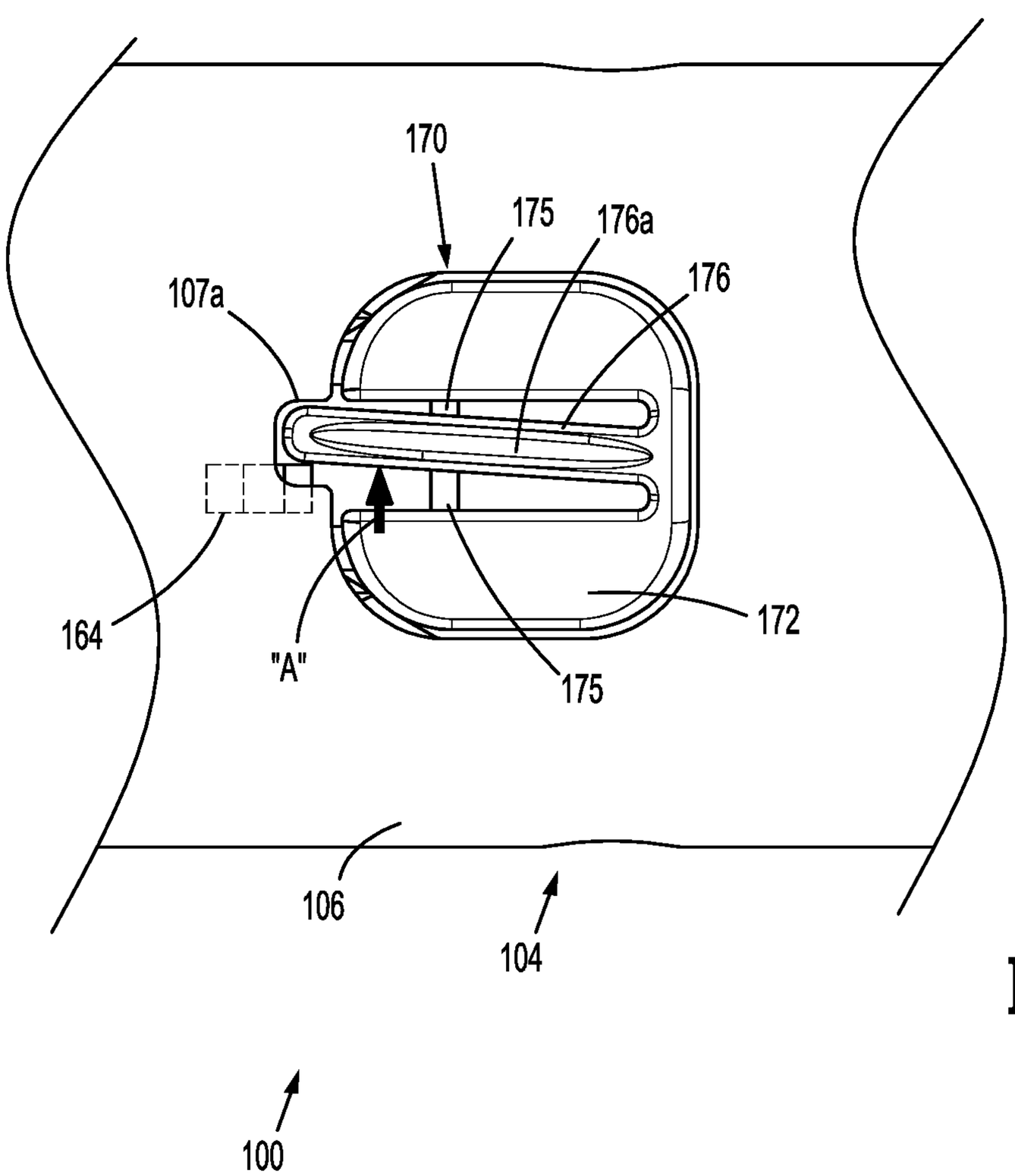

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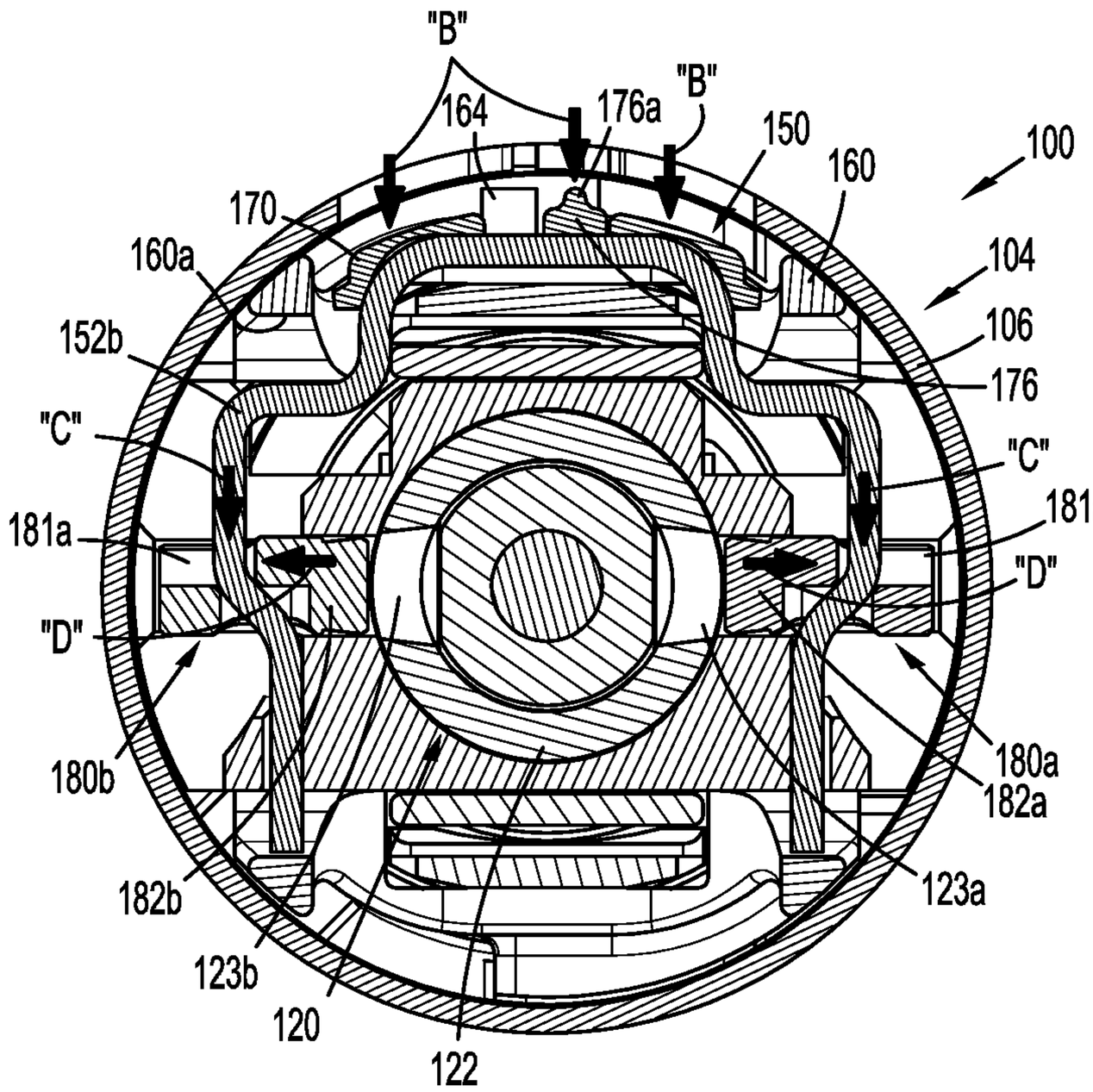
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160
100
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160a
104
152b
106
176
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"C"
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181a
"D"
"D"
180b
180a
182a
182b
123a
123b
120
122

FIG. 10

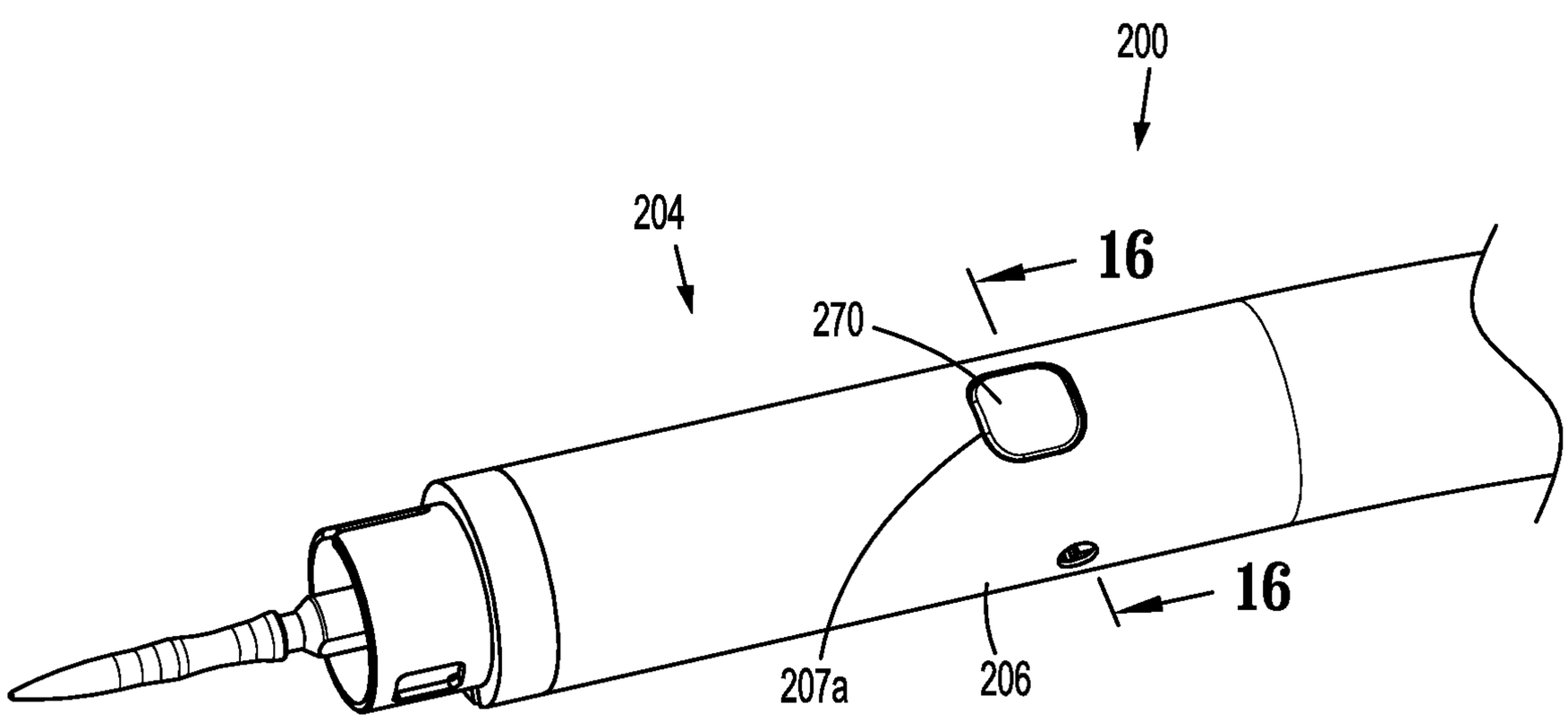
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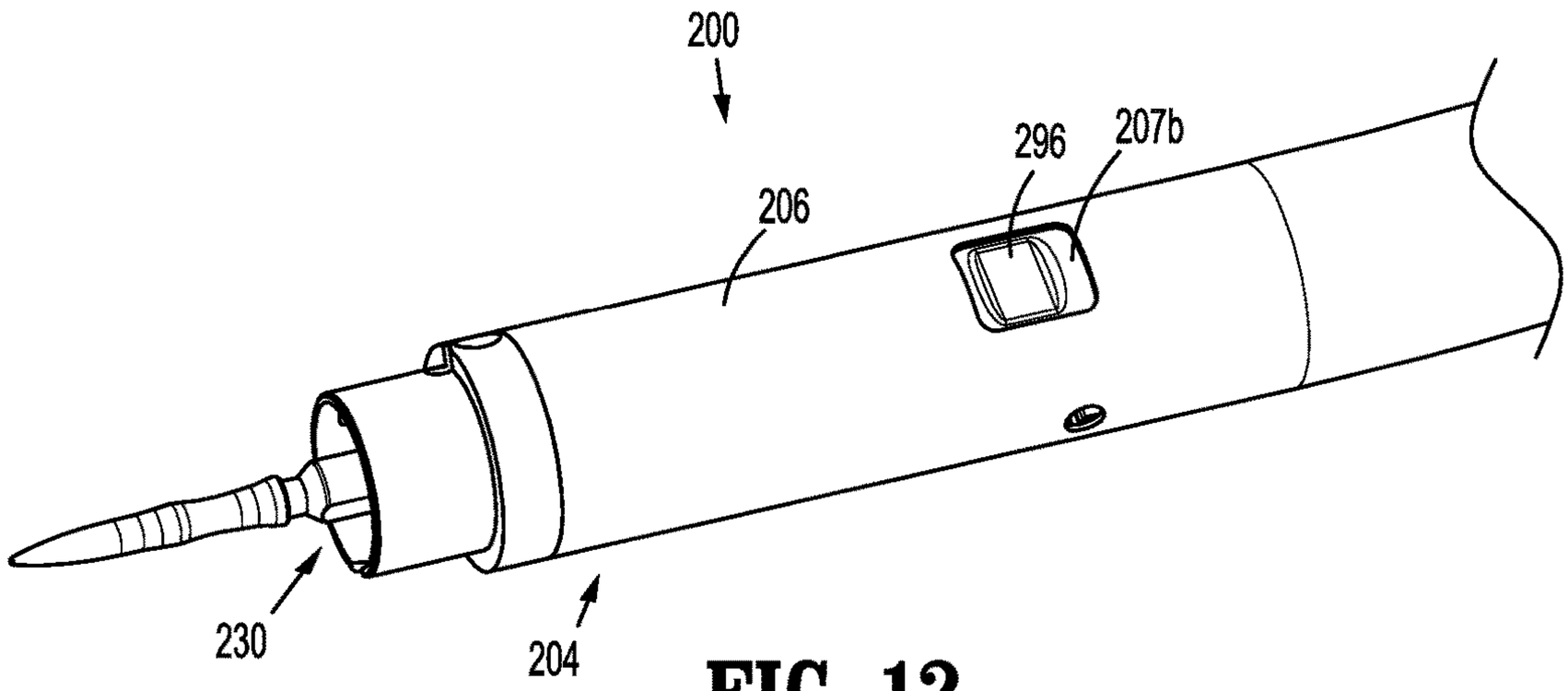
FIG. 11



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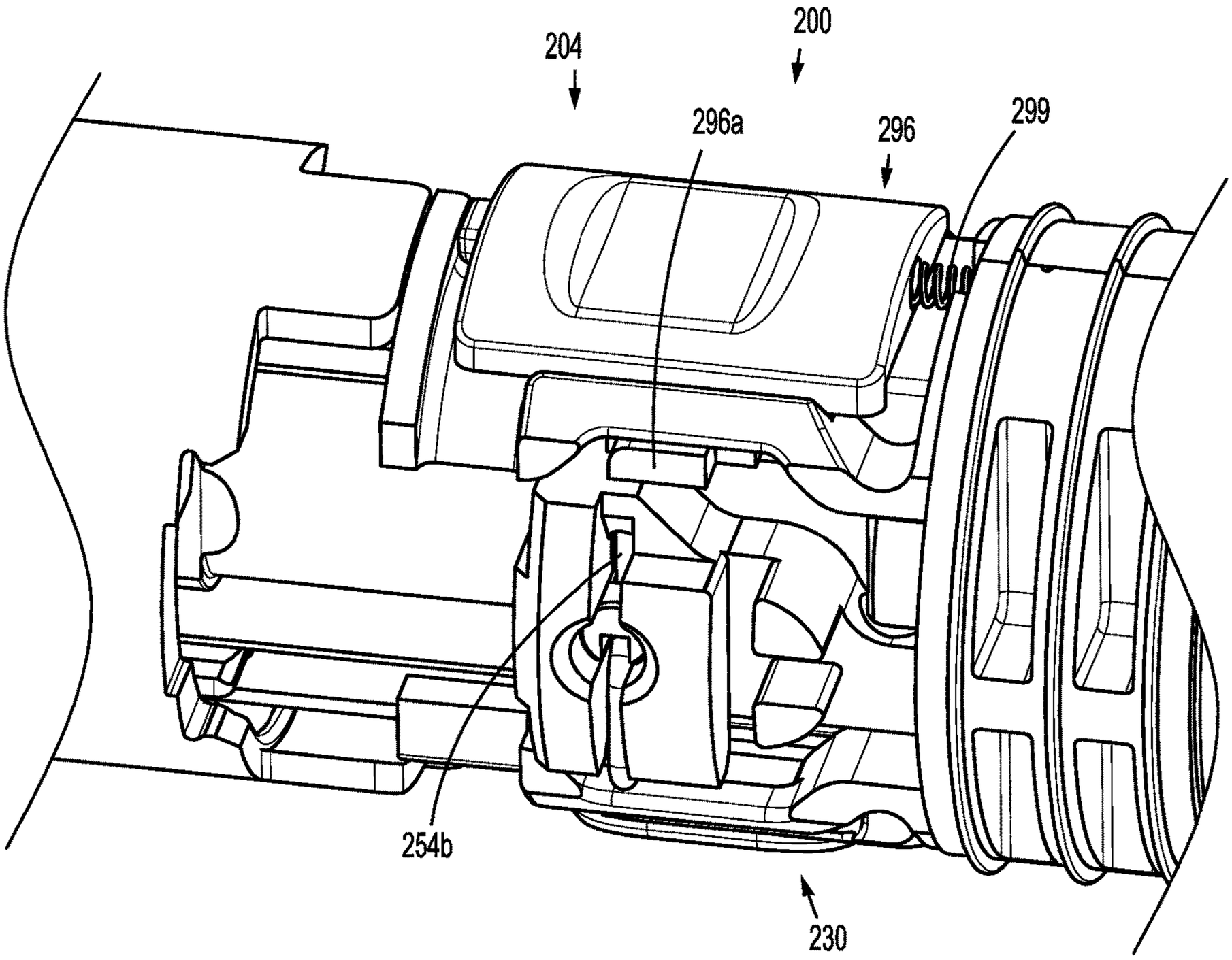


FIG. 13

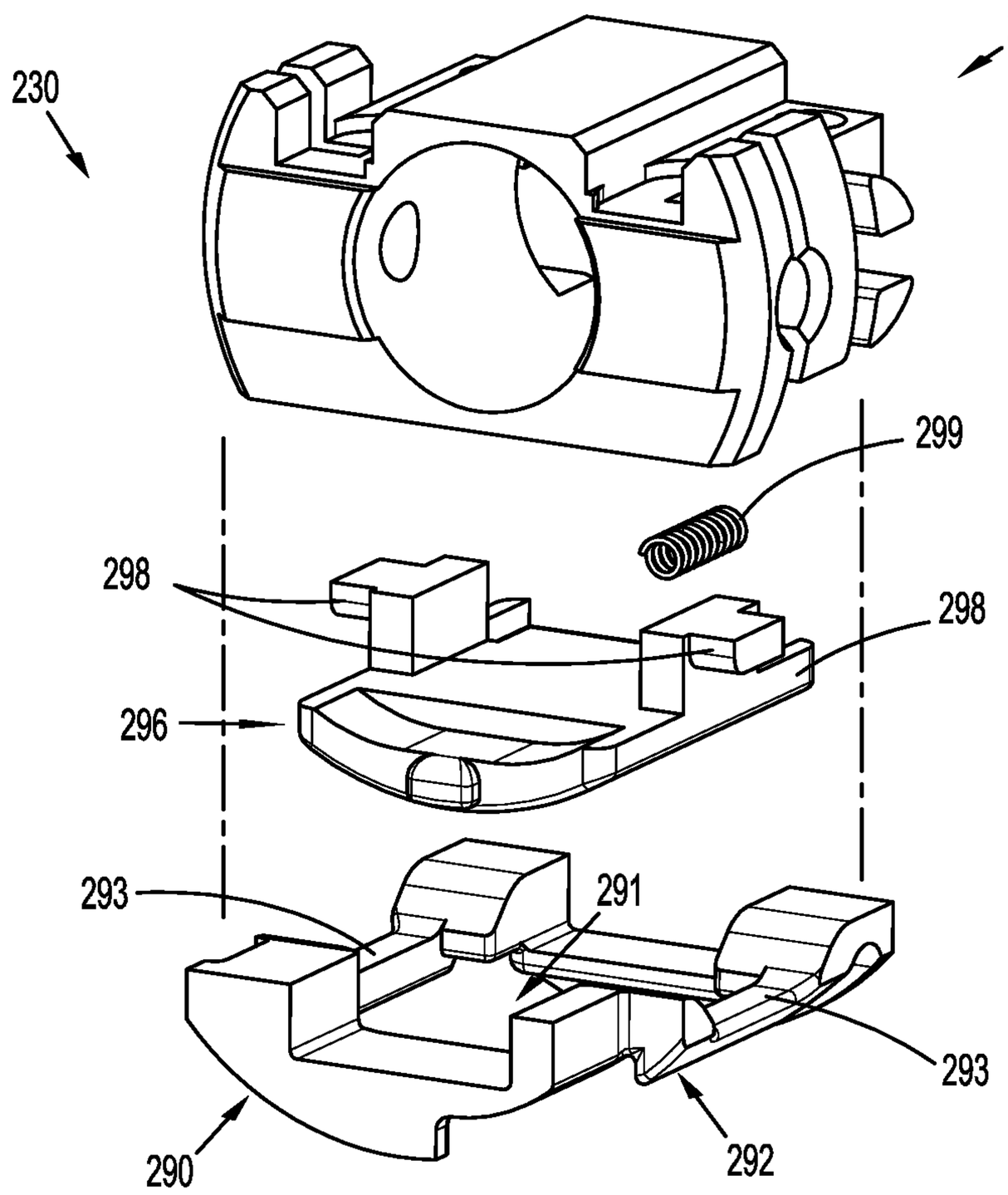


FIG. 14

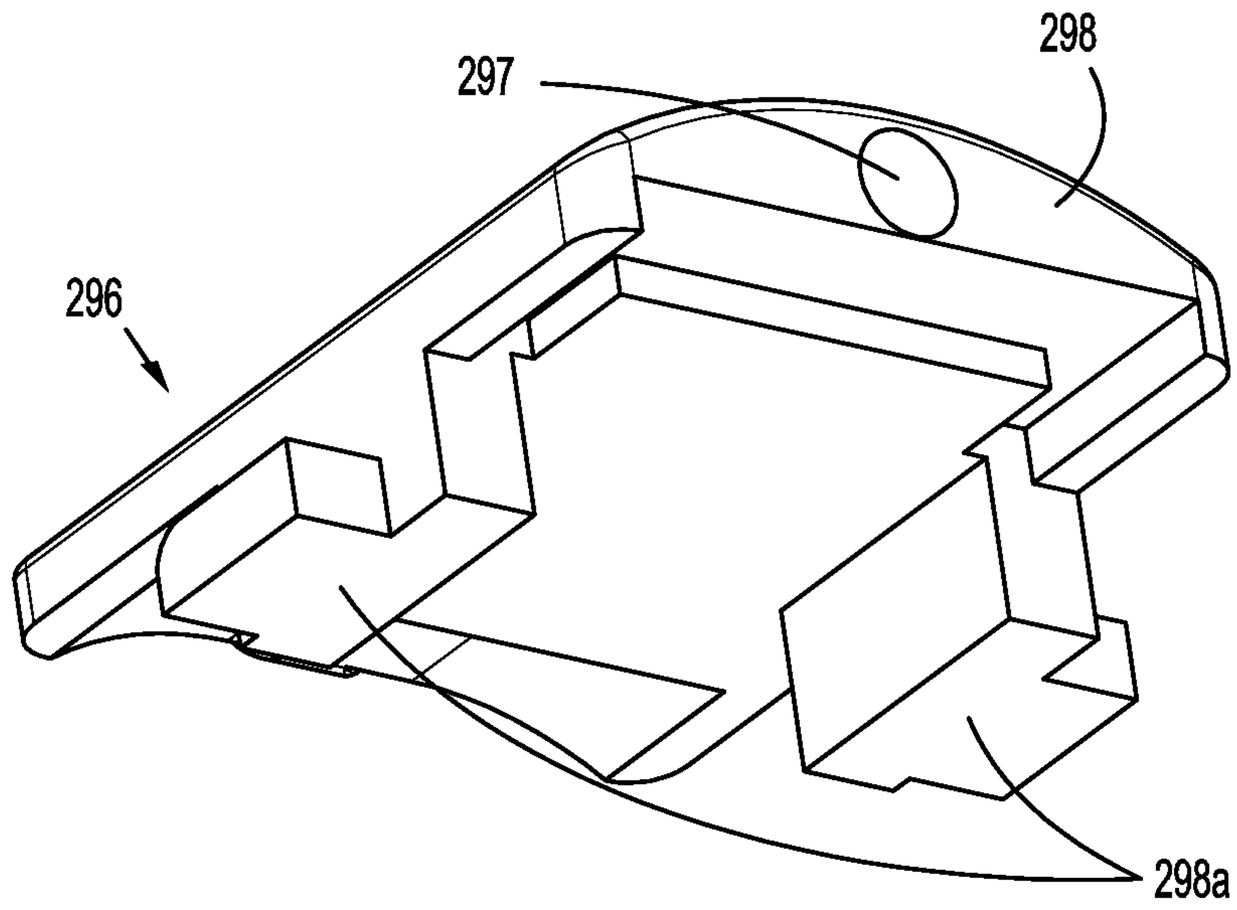
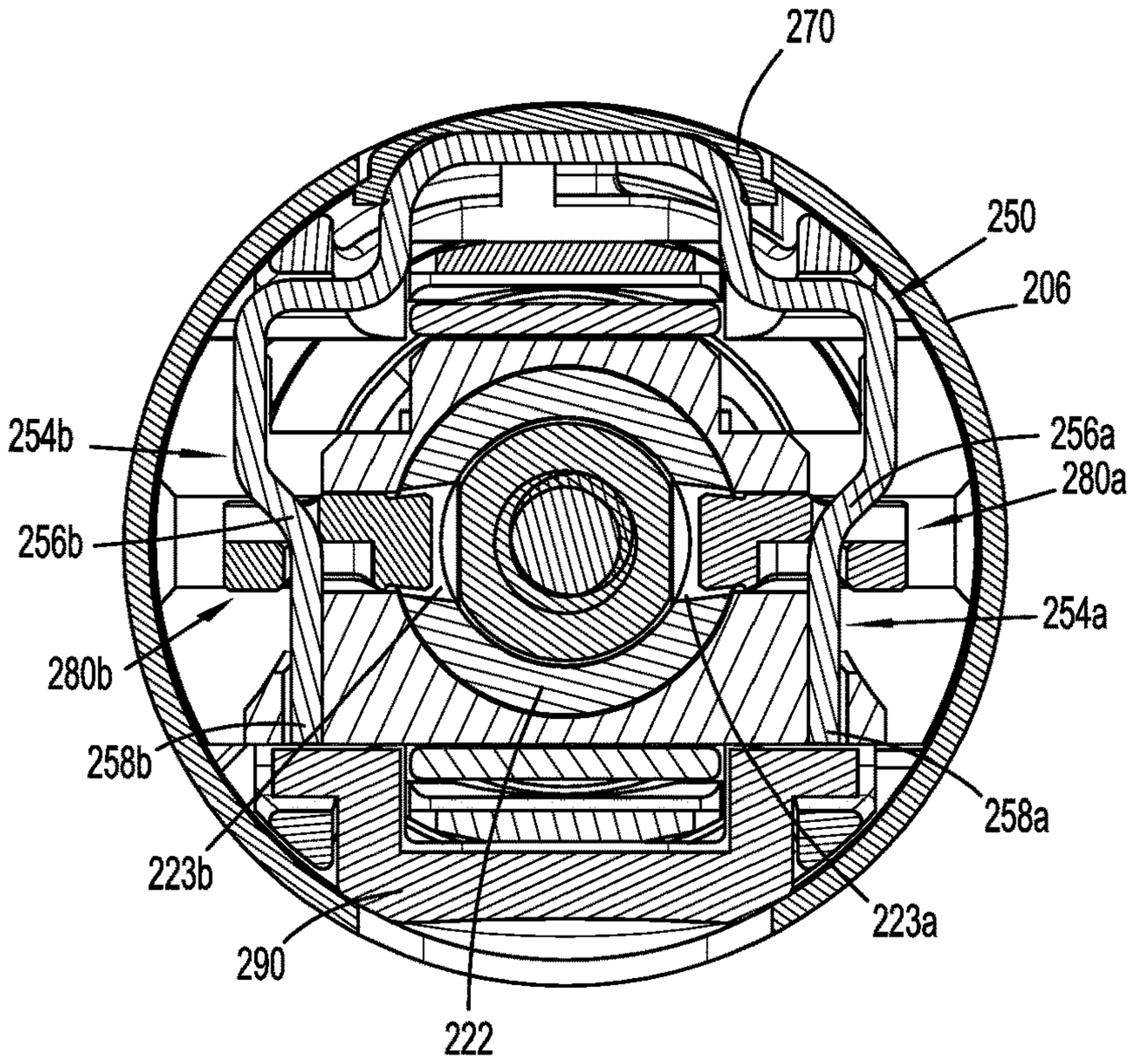


FIG. 15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206
254b
256a
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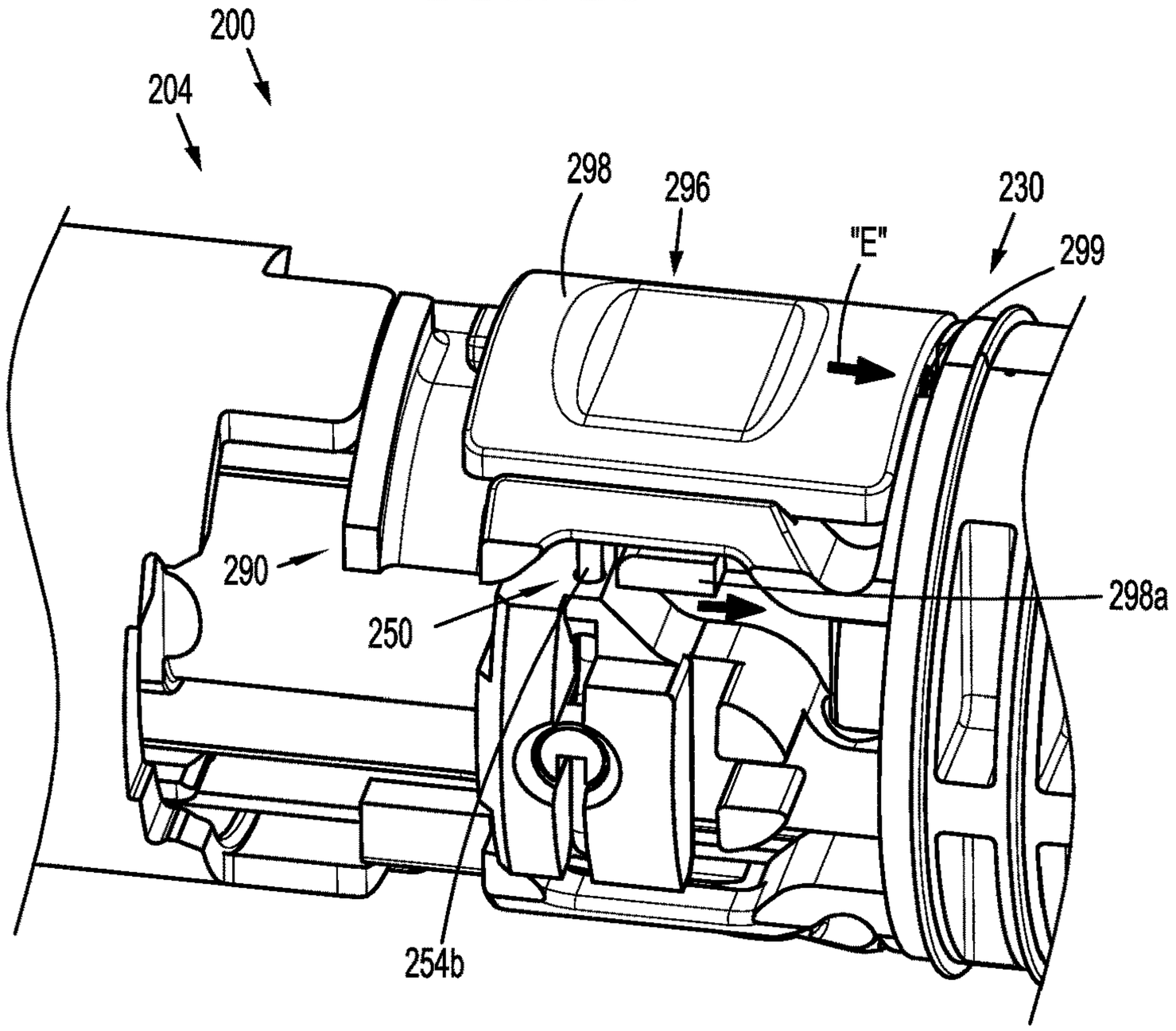
256b
254a
280b
258b
258a
223b
223a
290
222

FIG. 16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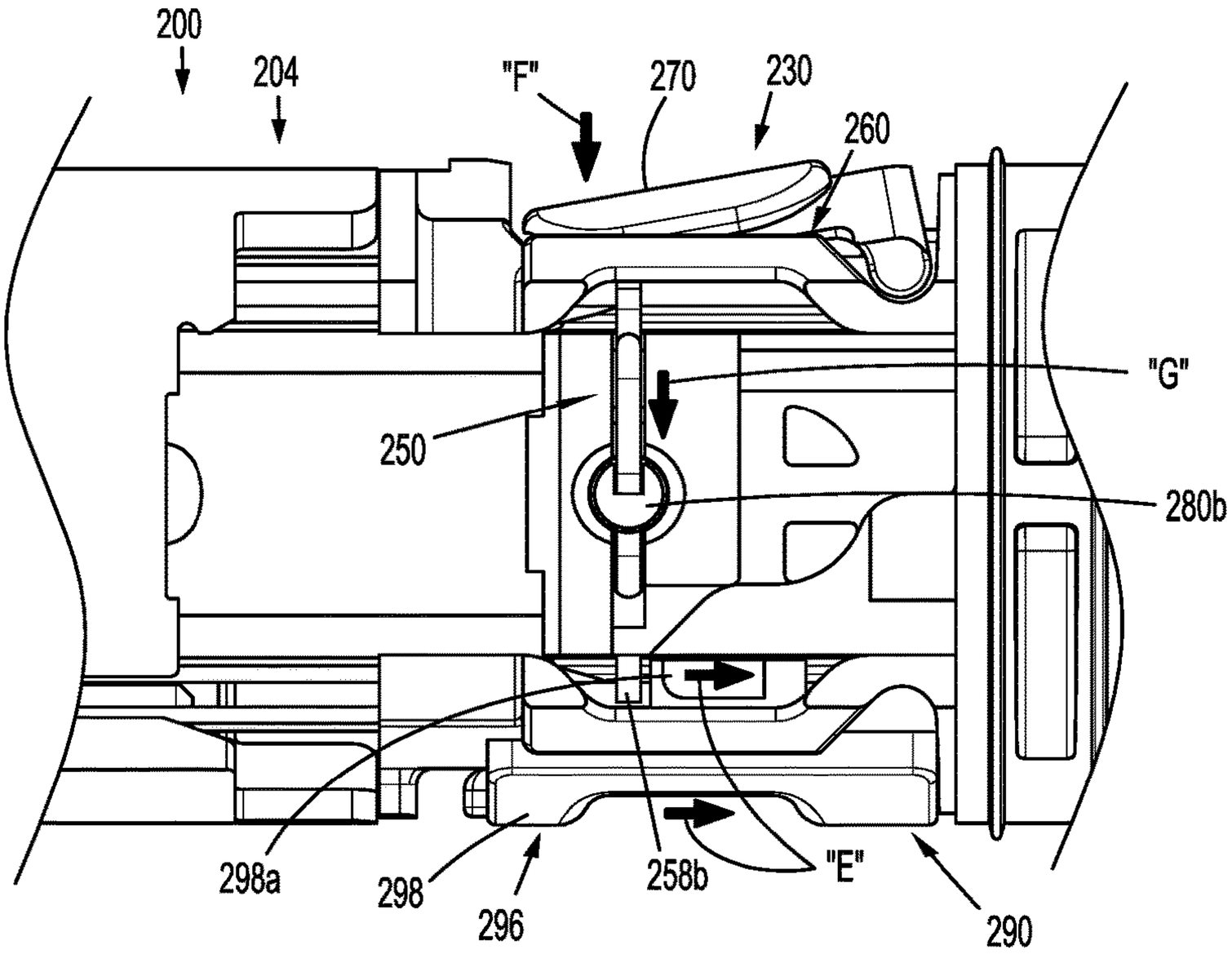
299
290
298a
250
254b

FIG. 17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"G"
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280b
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298
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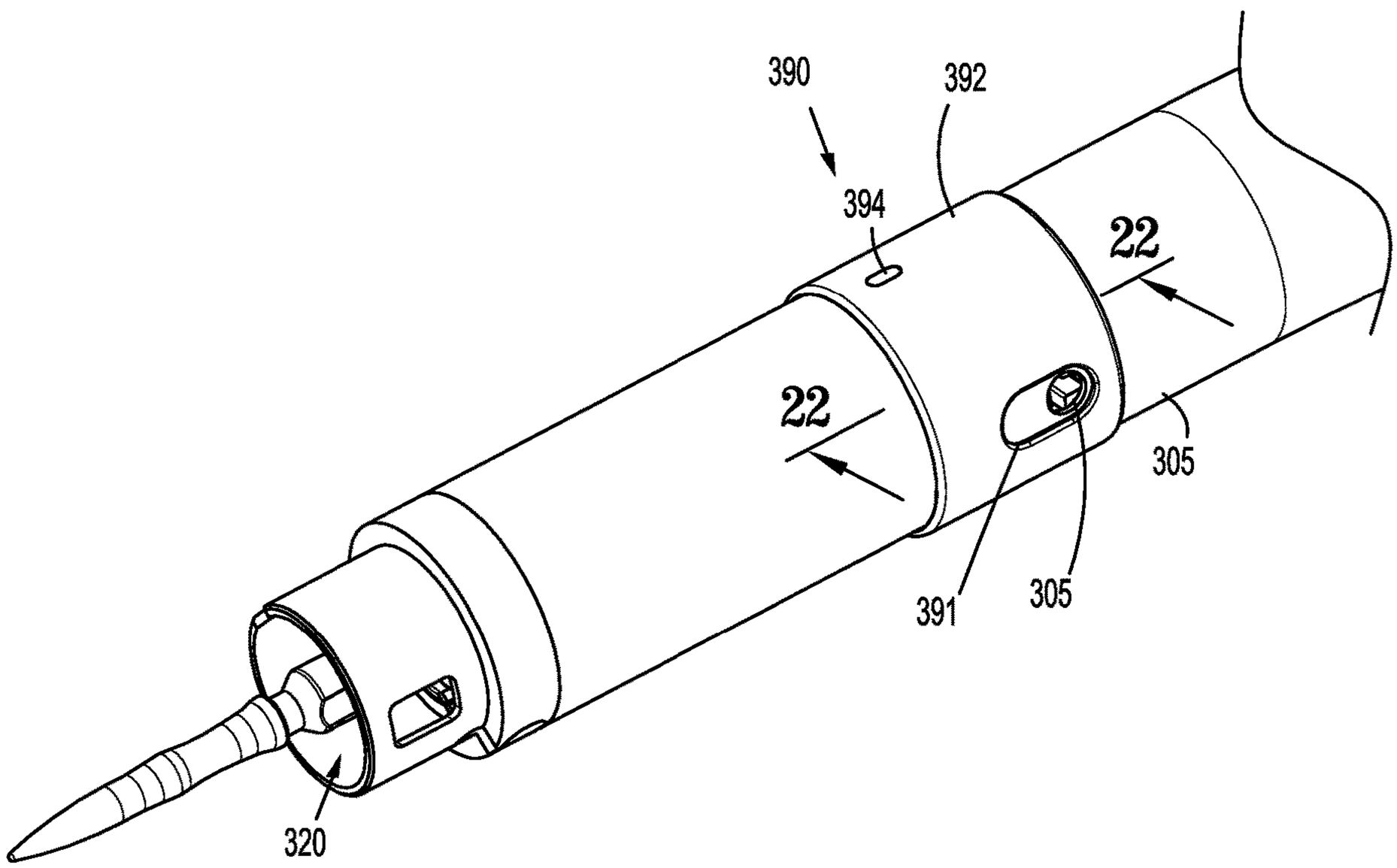
258b
"E"
290

FIG. 18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320

FIG. 19

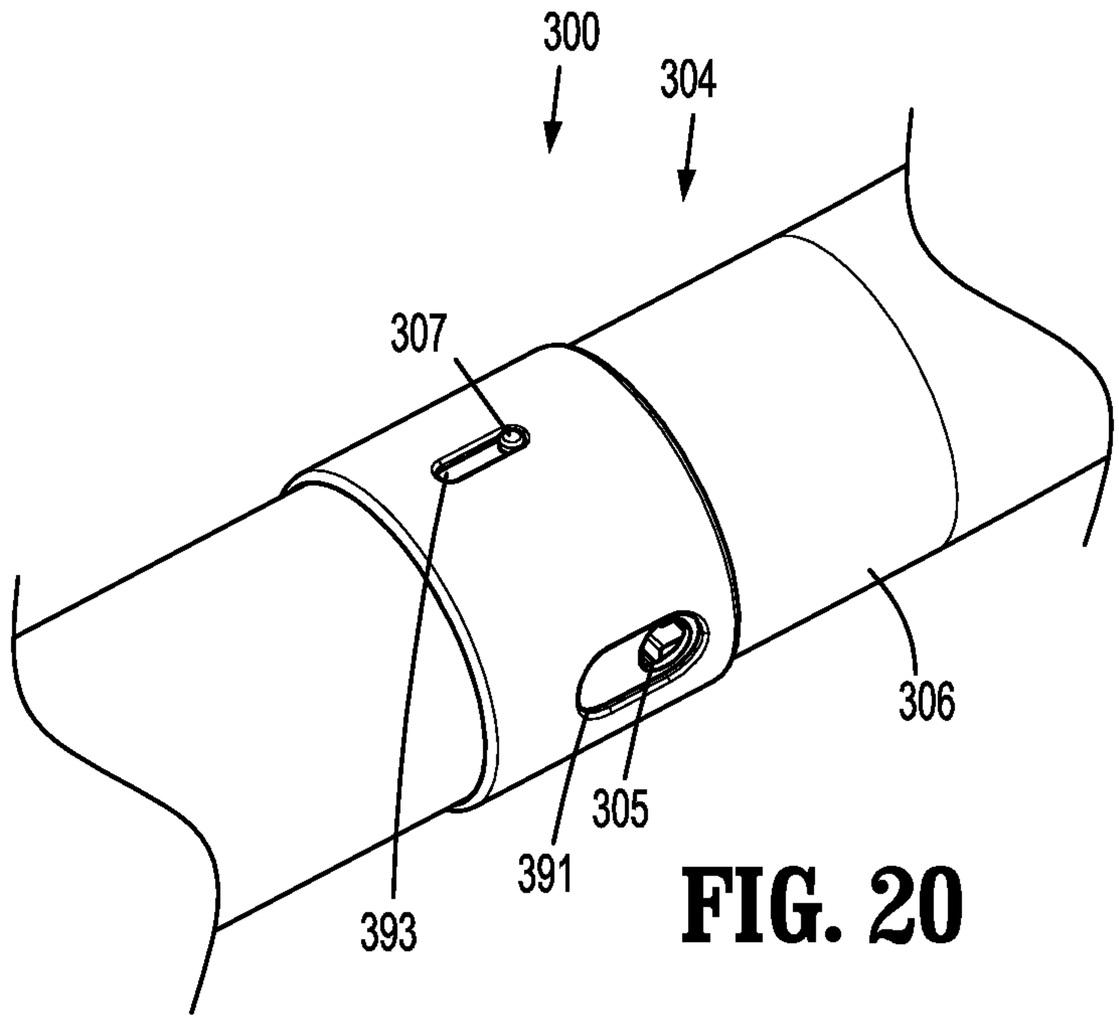


FIG. 20

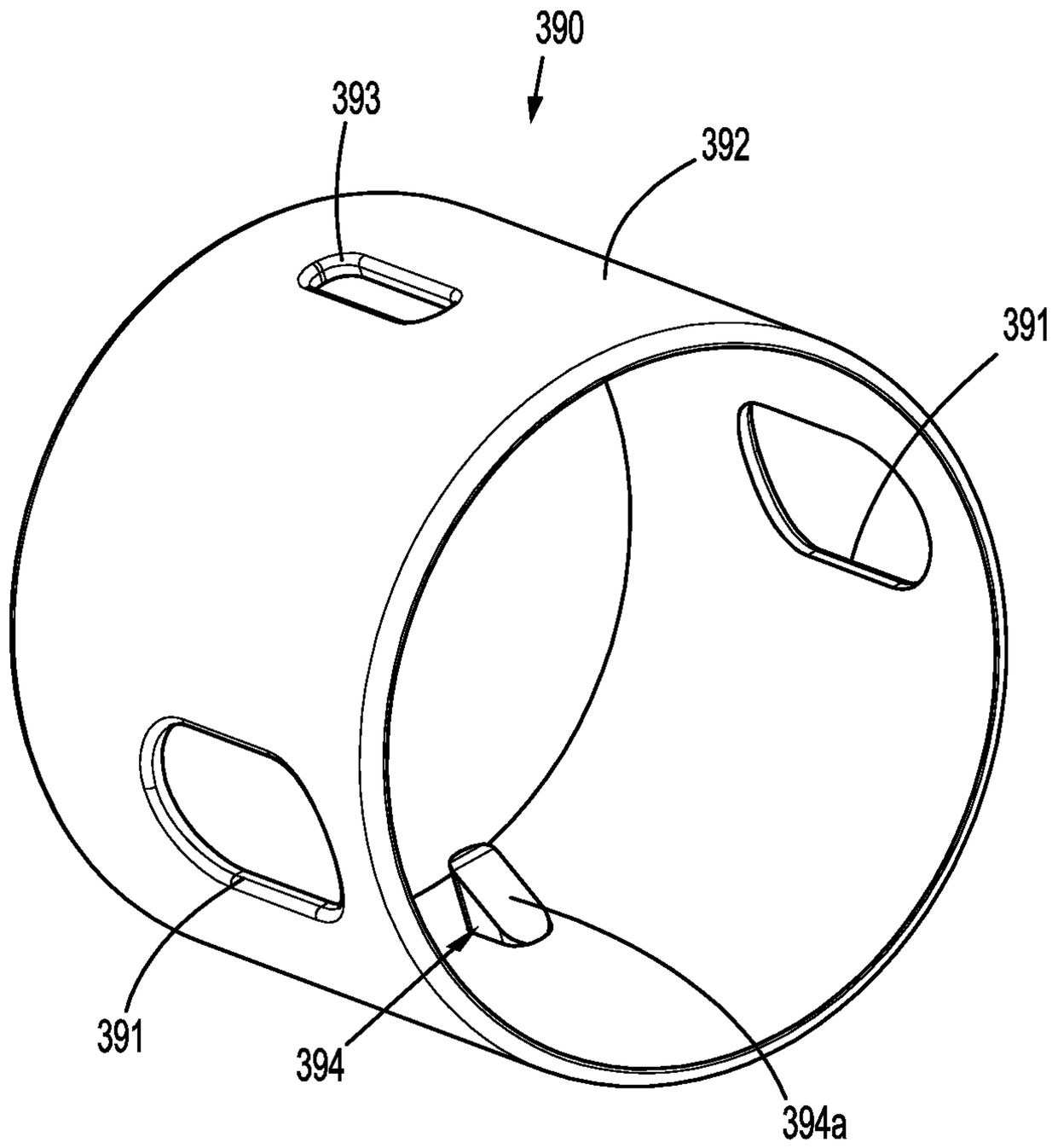
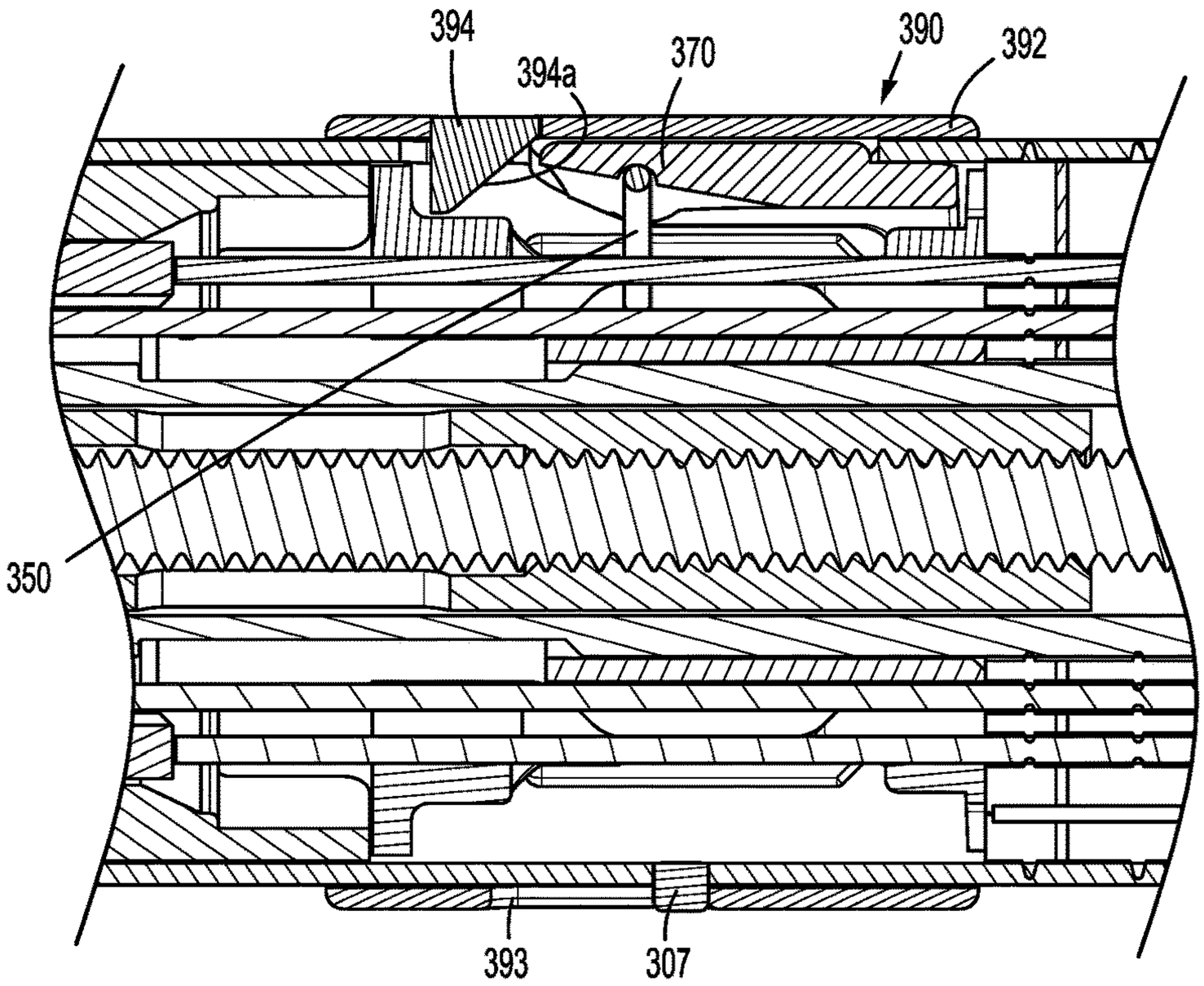


FIG. 21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350
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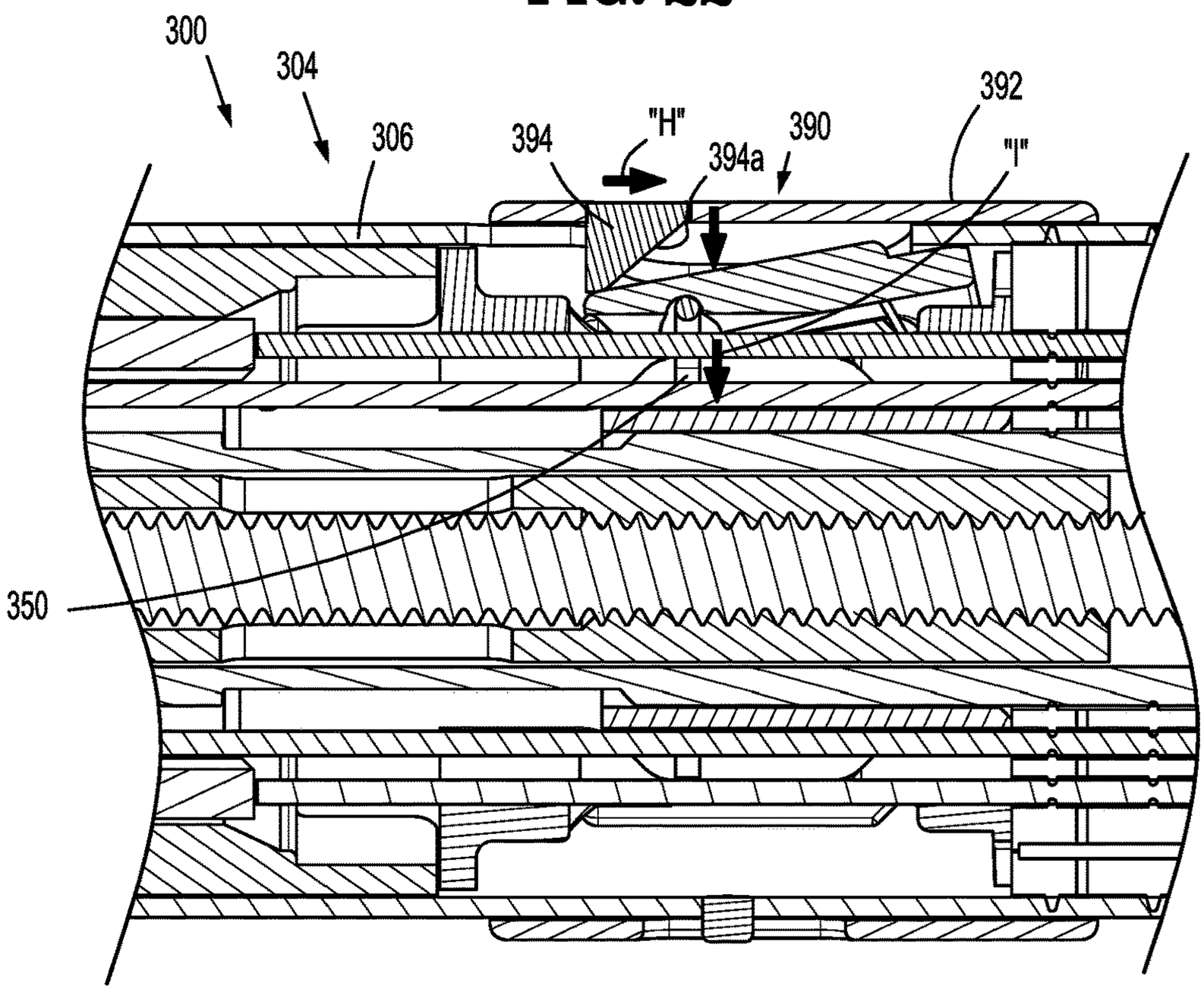
307

FIG. 22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394a
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"I"
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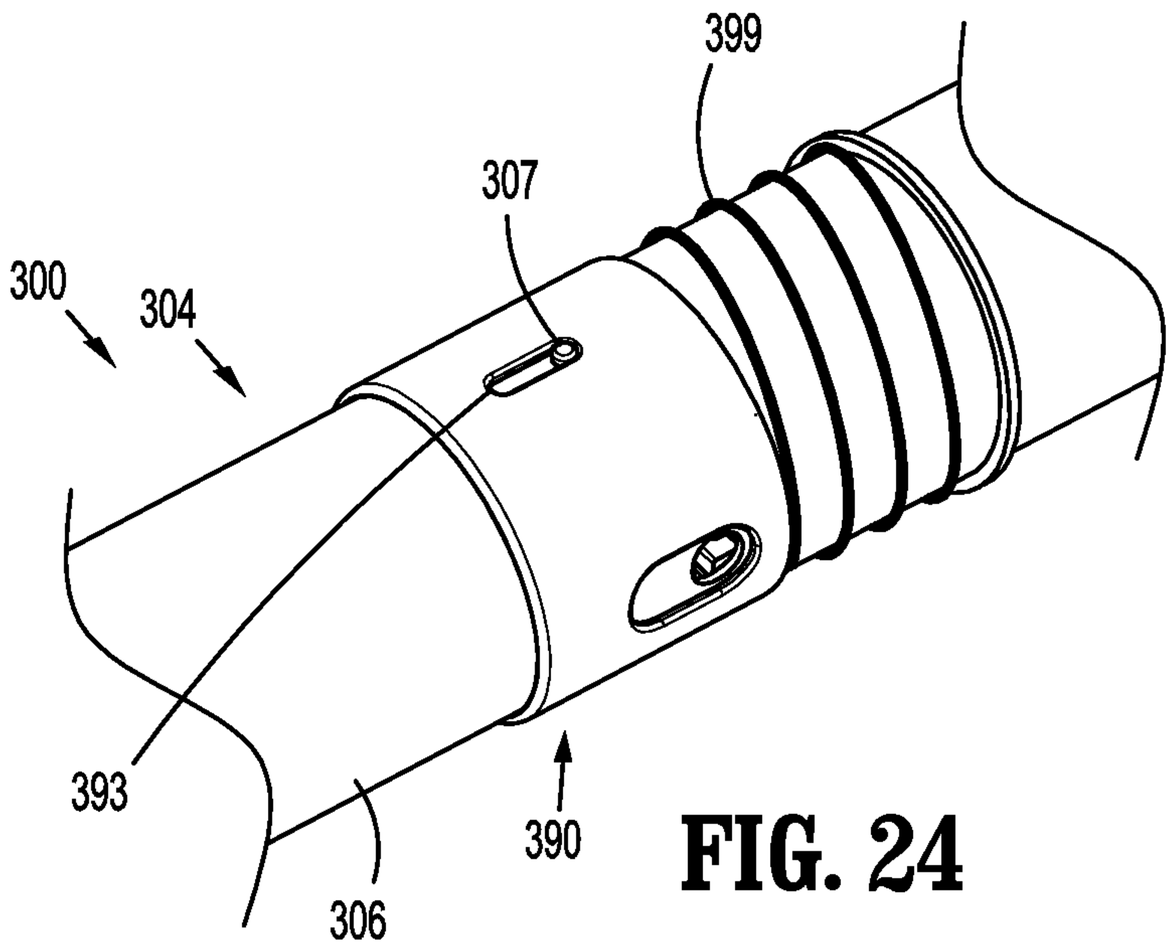
FIG. 23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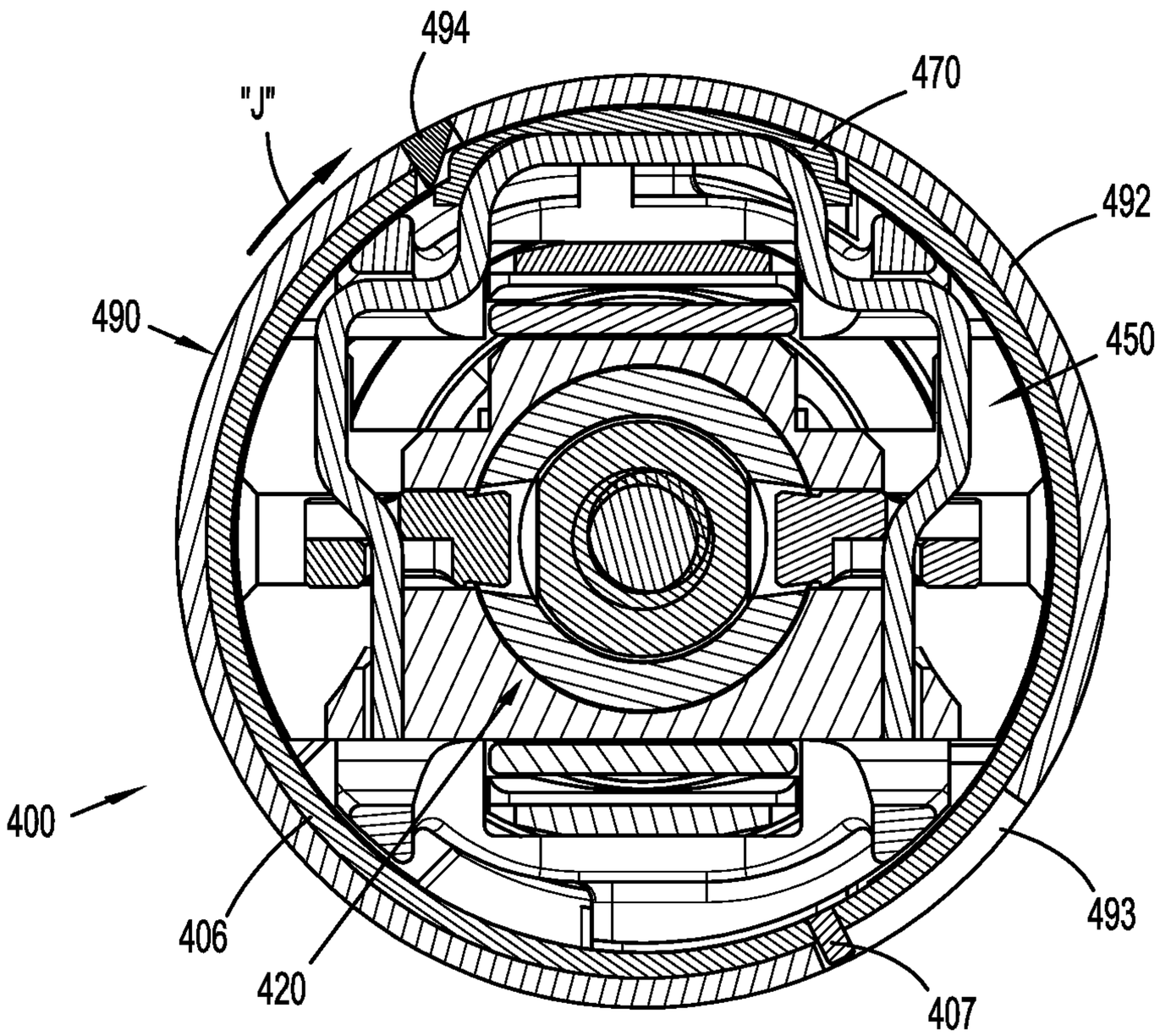
306

FIG. 24


494
"J"
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450
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406
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493
407

FIG. 25

RETAINING MECHANISMS FOR TROCAR ASSEMBLIES

FIELD

The disclosure relates to reusable adapter assemblies for surgical stapling devices. More particularly, the disclosure relates to retaining mechanisms for releasably securing removable trocar assemblies within reusable adapter assemblies.

BACKGROUND

Surgical devices for applying staples, clips, or other fasteners to tissue are well known. Typically, endoscopic stapling devices include an actuation unit, i.e., a handle assembly for actuating the device, a shaft for endoscopic access to a body cavity, and a tool assembly disposed at a distal end of the shaft. In certain of these devices, the shaft includes an adapter assembly having a proximal end securable to the handle assembly and a distal end securable to the tool assembly.

Circular stapling devices typically include a trocar assembly for supporting and positioning an attached anvil assembly in relation to a staple cartridge of the tool assembly. The trocar assembly may be releasably securable within the adapter assembly to permit cleaning, sterilizing, and reuse of the adapter assembly. It would be beneficial to have a retaining mechanism for releasably securing the trocar assembly to the adapter assembly.

SUMMARY

An adapter assembly for connecting a loading unit to a handle assembly includes an outer sleeve, a trocar assembly releasably securable within the outer sleeve, and a retaining mechanism configured to releasably secure the trocar assembly within the outer sleeve. The trocar assembly includes a trocar housing defining first and second openings. The retaining mechanism includes a retaining block, a cam wire moveably positioned relative to the retaining block between a lock position and a release position, a retaining block extension configured to maintain the cam wire relative to the retaining block, a button member in operable engagement with the cam wire, and a pair of retaining members moveable from a first position received within the first and second openings of the trocar assembly when the cam wire is in the lock position and a second position spaced from the trocar assembly when the cam wire is in the release position. The retaining block extension includes a stop tab. The button member includes a center beam moveable from an unflexed position in engagement with the stop tab of the retaining block extension to prevent movement of the button member to a flexed position out of alignment with the stop tab to permit movement of the button member.

In embodiments, the button member is pivotable relative to the retaining block from a non-depressed position when the center beam is in the unflexed position and a depressed position when the center beam is in the flexed position. Depression of the button member may cause the cam wire to move from the lock position to the release position.

The center beam may include a rib configured for operable engagement by a user. The button member may define a relief on either side of the center beam to permit movement of the center beam between the unflexed and flexed positions. The button member may define a midline. The stop member may be aligned with the midline. The center beam may be aligned with the midline when in the unflexed position and is misaligned with the midline when in the flexed position. The retaining block may define a central opening for receiving the trocar assembly. Each of the first and second retaining members may include a wedge-shaped free end.

Another adapter assembly for connecting a loading unit to a handle assembly includes an outer sleeve, a trocar assembly releasably securable within the outer sleeve, and a retaining mechanism configured to releasably secure the trocar assembly within the outer sleeve. The trocar assembly includes a trocar housing defining first and second openings. The retaining mechanism includes a retaining block, a cam wire moveably positioned relative to the retaining block between a lock position and a release position, an upper retaining block extension configured to maintain the cam wire relative to the retaining, a button member for moving the cam wire between the lock and release positions, a pair of retaining members moveable from a first position received within the first and second openings of the trocar assembly when the cam wire is in the lock position and a second position spaced from the trocar assembly when the cam wire is in the release position, a lower retaining block extension disposed opposite the upper retaining block extension, and a sliding button moveable between a first position in engagement with the cam wire to a second position spaced from the cam wire. Movement of the sliding button member relative to the lower retaining block permits movement of the cam wire from the lock position to the release position.

In embodiments, the cam wire includes first and second free ends and the sliding button member includes first and second stop members configured to engage the free ends of the cam wire to prevent movement of the cam wire to the release position. The sliding button member may be biased to the first position by a biasing member. The biasing member may be a coil spring. The sliding button member may be configured for operable engagement by a user. The button member may be pivotable relative to the upper retaining block extension.

The adapter assembly may include a collar assembly received about the outer sleeve. Movement of the collar assembly from a first position to a second positon moves the button member from the non-depressed position to the depressed position. The collar assembly may move proximally from the first position to the second position. Alternatively, the collar assembly is rotated about the outer sleeve when moved from the first position to the second position. The collar assembly may be biased to the first position by a coil spring. The outer sleeve may include a pin for engagement with the collar assembly to limit movement of the collar assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the disclosure and, together with a general description of the disclosure given above, and the detailed description of the embodiments given below, serve to explain the principles of the disclosure, wherein:

FIG. **1** is a perspective view of a surgical stapling device including an handle assembly and an adapter assembly according to an exemplary embodiment of the disclosure;

FIG. **2** is a perspective view of the adapter assembly shown in FIG. **1** with a removable trocar assembly extending from a distal portion of the adapter assembly;

FIG. **3** is a perspective view of the distal portion of the adapter assembly and the removable trocar assembly shown in FIG. **1**, with the removable trocar removed from within the adapter assembly;

FIG. **4** is an exploded view of the indicated area of detail shown in FIG. **3**;

FIG. **5** is a perspective view of the distal portion of the adapter assembly shown in FIG. **2**, with an outer sleeve removed to expose a retaining mechanism;

FIG. **6** is a side perspective view of the retaining mechanism shown in FIG. **5**, with components separated;

FIG. **7** is a cross-sectional end view the adapter assembly shown in FIG. **2** taken along line **7-7** shown in FIG. **3**, with the retainer mechanism in a lock position;

FIG. **8** is a top view of a portion of the adapter assembly including a button member of the retainer mechanism shown in FIG. **5**, with a center beam in a first or unflexed condition;

FIG. **9** is the top view shown in FIG. **8** with the center beam of the button member in a second of flexed condition;

FIG. **10** is the cross-sectional end view of the adapter assembly shown in FIG. **7**, with the retainer mechanism in a release position;

FIG. **11** is a first perspective view of a distal portion of an adapter assembly according to another embodiment of the disclosure;

FIG. **12** is a second perspective view of the distal portion of the adapter assembly shown in FIG. **11**;

FIG. **13** is a perspective view of the distal portion of the adapter assembly shown in FIG. **11**, with an outer sleeve removed to expose a retaining mechanism;

FIG. **14** is a side perspective view of the retaining mechanism shown in FIG. **13**, with components separated, and a cam wire, an upper retaining member, and a button member removed;

FIG. **15** is a perspective view of a lower retaining block extension of the retaining mechanism shown in FIG. **13**;

FIG. **16** is a cross-sectional end view of the adapter assembly shown in FIG. **11** taken along line **16-16** of FIG. **11**;

FIG. **17** is the perspective view of the distal portion of the adapter assembly shown in FIG. **13**, with a sliding button member of the retaining mechanism shown in FIG. **13** in a proximal position;

FIG. **18** is a side view of the retaining mechanism shown in FIG. **17**, with the sliding button member in the proximal position and the button member in a depressed condition;

FIG. **19** is a distal portion of an adapter assembly according to another exemplary embodiment of the disclosure including a collar assembly;

FIG. **20** is another perspective side view of a portion of the distal portion of the adapter assembly shown in FIG. **19**;

FIG. **21** is a perspective side view of the collar assembly shown in FIG. **19**;

FIG. **22** is a cross-sectional side view of the adapter assembly taken along line **22-22** of FIG. **19**, with the collar assembly in a distal position;

FIG. **23** is the cross-sectional side view shown in FIG. **22**, with the collar assembly in a proximal position;

FIG. **24** is a perspective side view of an adapter assembly according to yet another exemplary embodiment of the disclosure including a collar assembly and a biasing member for maintaining the collar assembly in a proximal position; and

FIG. **25** is a cross-sectional end view of an adapter assembly according to another exemplary embodiment of the disclosure including a collar assembly.

DETAILED DESCRIPTION

Embodiments of the disclosed adapter assembly including a retaining mechanism for securing a removable trocar assembly therein will now be described in detail with reference to the drawings in which like reference numerals designate identical or corresponding elements in each of the several views. As is common in the art, the term "proximal" refers to that part or component closer to the user or operator, i.e. surgeon or clinician, while the term "distal" refers to that part or component further away from the user.

Referring initially to FIG. **1**, an adapter assembly according to an embodiment of the disclosure, shown generally as adapter assembly **100**, is a component of a surgical stapling device **10**. The surgical stapling device **10** further includes a powered handle assembly **20** for actuating a loading unit **30**, and an anvil assembly **40** supported relative to the loading unit **30**. The loading unit **30** and the anvil assembly **40** form a tool assembly of the surgical stapling device **10**. Although shown and described with reference to surgical stapling device **10**, aspects of the disclosure may be modified for use with manual surgical stapling devices having various configurations, and with powered surgical stapling devices having alternative configurations. For a detailed description of exemplary surgical stapling devices, please refer to U.S. Pat. Nos. 9,023,014 and 9,055,943. With reference to FIG. **2**, the adapter assembly **100** includes a proximal portion **102** configured for operable connection to the handle assembly **20** (FIG. **1**) and a distal portion **104** configured for operable connection to the loading unit **30** (FIG. **1**) and to the anvil assembly **40** (FIG. **1**). Although shown and described as forming an integral unit, it is envisioned that the proximal and distal portions **102**, **104** may be formed as separate units that are releasably securable to one another.

The adapter assembly **100** will only be described to the extent necessary to fully disclose the aspects of the disclosure. For a detailed description of an exemplary adapter assembly, please refer to U.S. Pat. No. 10,226,254 ("the '254 patent").

With additional reference to FIGS. **3** and **4**, the adapter assembly **100** includes an outer sleeve **106**, and a connector housing **108** secured to a distal end of the outer sleeve **106**. The connector housing **108** is configured to releasably secure a loading unit, e.g., the loading unit **30** (FIG. **1**), to the adapter assembly **100**. The outer sleeve **106** defines a flush port **105** (FIG. **3**) and an opening **107** through which a button member **170** of a trocar retaining mechanism **130** is operably disposed. As will be described in further detail below, the outer sleeve **106** further includes an asymmetric cutout **107***a* (FIG. **4**) in communication with the opening **107**.

With additional reference to FIG. **5**, the adapter assembly **100** further includes a trocar assembly **120** (FIG. **3**), and a retaining mechanism **130** releasably securing the trocar assembly **120** relative to the outer sleeve **106** (FIG. **3**) of the adapter assembly **100**. The trocar assembly **120** will only be described to the extent necessary to fully describe the aspects of the disclosure. For a detailed description of the structure and function of an exemplary trocar assembly, please refer to the '254 patent. With particular reference to FIG. **3**, the trocar assembly **120** of the adapter assembly **100** (FIG. **2**) includes a trocar housing **122**, a trocar member **124** slidably disposed within the trocar housing **122**, and a drive screw **126** operably received within the trocar member **124** for axially moving the trocar member **124** relative to the trocar housing **122**. The trocar housing **122** defines first and second locking openings **123***a*, **123***b* (FIG. **7**) for receiving

respective locking portions **182***a*, **182***b* of first and second retainer members **180***a*, **180***b* (FIG. **6**) of a retaining mechanism **130** of the adapter assembly **100**.

Turning briefly to FIG. **7**, the retaining mechanism **130** of the adapter assembly **100** is disposed between first and second drive members **110***a*, **110***b*, **112***a*, **112***b* of respective inner and outer drive assemblies **110**, **112**. The first and second drive assemblies **110**, **112** are operably connected to first and second drive shafts (not shown) in a proximal portion **102** of the adapter assembly **100** for effecting operation of a loading unit, e.g., the loading unit **30** (FIG. **1**), to perform first and second functions. More particularly, the first and second drive members **110***a*, **110***b*, **112***a*, **112***b* of the respective first and second drive assemblies **110**, **112** are configured for longitudinal movement within the distal portion **104** of the adapter assembly **100**. In embodiments, advancement of the first drive assembly **110** effects tissue stapling, and advancement of the second drive assembly **112** effects tissue cutting.

The first and second drive assemblies **110**, **112** will only be described to the extent necessary to fully disclose the aspects of the disclosure. For a detailed description of exemplary drive assemblies, please refer to the '254 patent. With reference now to FIGS. **5** and **6**, the retaining mechanism **130** of the adapter assembly **100** includes a retaining block **140**, a cam wire **150** (FIG. **6**) supported by the retaining block **140**, a retaining block extension **160** for maintaining the cam wire **150** relative to the retaining block **140**, a button member **170** in operable engagement with the cam wire **150** and pivotally supported relative to the retaining block **140**, and first and second retainer members **180***a*, **180***b* (FIG. **6**) supported by the cam wire **150** within the retaining block **140**.

With particular reference to FIG. **6**, the retaining block **140** of the retaining mechanism **130** defines a central opening **141** for receiving the trocar assembly **120** (FIG. **3**), first and second opposed cylindrical openings **143***a*, **143***b* in communication with the central opening **141** for receiving the respective first and second retainer members **180***a*, **180***b*, and a channel or slot **145** extending about a perimeter of the retaining block **140** and through the first and second cylindrical openings **143***a*, **143***b* in the retaining block **140** for receiving the cam wire **150**. The first and second retainer members **180***a*, **180***b* of the retaining mechanism **130** are supported within the first and second cylindrical openings **143***a*, **143***b* of the retaining block **140** by the cam wire **150** and are configured to be received within first and second locking openings **123***a*, **123***b* of the trocar housing **122** of the trocar assembly **120** when the trocar assembly **120** is fully received within the distal portion **104** (FIG. **2**) of the adapter assembly **100**.

The cam wire **150** of the retaining mechanism **130** includes a substantially U-shaped member having a backspan **152**, and first and second legs **154***a*, **154***b* extending from the backspan **152**. The backspan **152** includes a button engagement portion **152***a* and a pair of shoulders portions **152***b* on either side of the button engagement portion **152***a*. Each of the first and second legs **154***a*, **154***b* includes an opposed angled section **156***a*, **156***b*. The cam wire **150** is received within the channel **145** of the retaining block **140**. As will be described in further detail below, the cam wire **150** is moveable between a first or lock position (FIG. **8**) when the button member **170** is in an initial or non-depressed position, and a second or release position when the button member **170** is depressed.

With continued reference to FIG. **6**, the retaining block extension **160** includes a substantially rectangular frame **162** defining an opening **161** and a pair semi-cylindrical recesses **163**. First and second pivot portions **174** (only one shown) of the button member **170** are pivotally supported within the semi-cylindrical recesses **163** in the frame **162** and a body portion **172** of the button member is disposed within the opening **161** in the frame **162**. The frame **162** includes a pair of stop surfaces **162***a* (FIG. **7**) for engaging the shoulder portions **152***b* of the backspan **152** of the cam wire **150**, and a stop member, e.g., a stop tab **164**, along a midline "m" of the frame **162** for inhibiting depression of the button member **170**.

The button member **170** of the retaining mechanism **130** of the adapter assembly **100** (FIG. **2**) includes the body portion **172** configured for operable engagement by a user, and the pair of pivot portions **174** configured for reception within the pair of semi-cylindrical recesses **163** of the retaining block extension **160**. The button member **170** is configured to engage the engagement portion **152***a* of the backspan **152** of the cam wire **150**. In embodiments, the backspan **152** of the cam wire **150** is secured to the button member **170**. For example, and as shown, the body portion **172** of the button member **170** defines a cavity **171** (FIG. **7**A) in with the engagement portion **152***a* of the back span **152** is retained through friction fit. Alternatively, the backspan **152** is secured within the cavity **171** with mechanical fasteners, bonding, welding, adhesives, or in any other suitable manner. The retaining mechanism **130** may include a biasing member, e.g., leaf springs **178** (FIG. **6**) for biasing the cam wire **150** outwardly to the first position, and/or the button member **170** outwardly to the non-depressed position (FIG. **7**).

The button member **170** of the trocar retaining mechanism **130** further includes a center beam **176**, and defines a relief **175** on either side of the center beam **176**. The center beam **176** includes a rib **176***a*, or is otherwise configured for engagement by a user. The center beam **176** and reliefs **175** are configured such that the center beam **176** may be flexed away from a midline "M" of the button member **170**. More particularly, the center beam **176** of the button member **170** is configured to align with the stop tab **164** of the retaining block extension **160** when the center beam **176** is in an initial or unflexed condition. In this manner, the center beam **176** of the button member **170** prevents the button member **170** from being depressed. As will be described in further detail below, flexing of the center beam **176** away from the midline "M" of the button member **170** moves the center beam **176** out of alignment with the stop tab **164** of the retaining block extension **160**, thereby permitting depression of the button member **170**. The reliefs **175** in the button member **170** may also facilitate flushing and cleaning of the adapter assembly **100** (FIG. **2**)

The first and second retaining members **180***a*, **180***b* of the retaining mechanism **130** form substantially cylindrical bodies **182***a*, **182***b* and are supported on the angled portions **156***a*, **156***b* of the respective first and second legs **154***a*, **154***b* of the cam wire **150**. In embodiments, the first and second retaining members **180***a*, **180***b* form a wedge-shaped configuration to be received within wedge-shaped first and second locking openings **123***a*, **123***b* in the trocar housing **122** of the trocar assembly **120**. The first and second retaining members **180***a*, **180***b* may include an inclined inner surface (not shown) to facilitate receipt of the trocar assembly **120** through the retaining block **140**.

The first and second retaining members **180***a*, **180***b* each define a stepped opening **181***a*, **181***b* through which the respective angled portion **156***a*, **156***b* of the cam wire **150** is received. The cam wire **150** and the stepped openings **181***a*,

181*b* of the respective first and second retaining members **180***a*, **180***b* are configured such that when the cam wire **150** is in the first position, the first and second retaining members **180***a*, **180***b* extend from within the retaining block **140** into the central passage **141**. In this manner, when a trocar assembly **120** is fully seated within the distal portion **104** (FIG. **2**) of the adapter assembly **100**, the first and second retaining members **180***a*, **180***b* are received within the respective first and second locking openings **123***a*, **123***b* (FIG. **7**) of the trocar housing **122** of the trocar assembly **120**. Conversely, when the cam wire **150** is in the second or release position, the first and second retainer members **180***a*, **180***b* are retracted from within the central opening **141** of the retaining block **140** to permit insertion and/or removal of the trocar assembly **120** from the distal portion **104** of the adapter assembly **100**.

With reference now to FIGS. **7** and **8**, the retaining mechanism **130** of the adapter assembly **100** is shown in a first or lock configuration, with the trocar assembly **120** securely received within the distal portion **104** of the adapter assembly **100**. In the lock configuration, the cam wire **150** of the retaining mechanism **130**, which is secured to the button member **170**, is biased to the first position by the leaf springs **178** (FIG. **6**). In the first position, the shoulder portions **152***b* of the backspan **152** of the cam wire **150** engage the stop surface **162***a* of the retaining block extension **160**. As noted above, when the cam wire **150** is in the first position and the trocar assembly **120** is fully seated within the distal portion **104** (FIG. **2**) of the adapter assembly **100**, the first and second retainer members **180***a*, **180***b* are received within the respective first and second locking openings **123***a*, **123***b* in the trocar housing **122** of the trocar assembly **120**.

The center beam **176** of the button member **170** of the retaining mechanism **130** is shown in the first or unflexed position. In the unflexed position, the center beam **176** aligns with the midline "M" of the button member **170**. When aligned with the midline "M", the center beam **176** engages the stop tab **164** of the retaining block extension **160** which is also aligned with the midline "M" of the button member **170**, thereby preventing the button member **170** from being depressed.

Turning to FIG. **9**, following use of the adapter assembly **100**, or to otherwise remove the trocar assembly **120** from the distal portion **104** of the adapter assembly **100**, the rib **176***a* of the center beam **176** of the button member **170** of the retaining mechanism **130** is moved off-center, or away from the midline "M" of the button member **170**, to the flexed position, as indicated by arrow "A", to move the center beam **176** of the button member **170** out of alignment with the stop tab **164** of the retaining block extension **160**. As noted above, when the center beam **176** of the button member **170** is misaligned with the stop tab **164** of the retaining block extension **160**, the stop tab **164** no longer obstructs or inhibits the button member **170** from being depressed.

With reference to FIG. **10**, with the center beam **176** of the button member **170** is in the flexed position, the button member **170** is able to be depressed, as indicated by arrows "B". Depression of the button member **170** causes the cam wire **150** to move from its first position (FIG. **7**) to its second position, as indicated by arrows "C". As the cam wire **150** moves to the second position, engagement of the angled portions **156***a*, **156***b* of the first and second legs **154***a*, **154***b*, respectively, with the respective first and second retainer members **180***a*, **180***b* cause the first and second retainer members **180***a*, **180***b* to move radially outward, as indicated by arrows "D". Radial outward movement of the first and second retaining members **180***a*, **180***b* withdraws the first and second retaining members **180***a*, **180***b* from within the respective first and second locking openings **123***a*, **123***b* of the trocar housing **122** of the trocar assembly **120** to permit removal of the trocar assembly **120** from within the distal portion **104** of the adapter assembly **100** (FIG. **2**).

FIGS. **11-18** illustrate another embodiment of a retaining mechanism according to the disclosure shown generally as retaining mechanism **230** (FIG. **13**). The retaining mechanism **230** is substantially similar to the retaining mechanism **130** described hereinabove and will only be described in detail with regards to the differences therebetween. The retaining mechanism **230** releasably secures a trocar assembly **220** within a distal portion **204** of an adapter assembly **200**. The trocar assembly **220** includes a trocar housing **222** (FIG. **16**) defining first and second locking openings **223***a*, **223***b* for receiving retaining members **280***a*, **280***b* (FIG. **16**), respectively, of the retaining mechanism **230**.

With particular reference to FIGS. **13** and **14**, the retaining mechanism **230** of the access assembly **200** includes a retaining block **240** (FIG. **13**), a cam wire **250** (FIG. **16**) moveably positioned relative to the retaining block **240**, an upper retaining block extension **260** securing the cam wire **250** relative to the retaining block **240**, a button member **270** pivotally supported by the upper retaining block **260** and in operable engagement with the cam wire **250**, first and second retaining members **280***a*, **280***b* in operable engagement with the cam wire **250** and moveably disposed within the retaining block **230**, a lower retaining block extension **290** disposed opposite the upper retaining block **260** in engagement with the retaining block **240**, and a sliding button member **296** slidably supported on the lower retaining block extension **290**.

The retaining block **240**, cam wire **250**, and first and second retaining members **280***a*, **280***b* of the retaining mechanism **230** of the access assembly **200** are substantially similar to the retaining block **140**, cam wire **150**, and first and second retaining members **180***a*, **180***b* described above. The upper retaining block extension **260** and the button member **270** are also substantially similar to the retaining block extension **160** and the button member **170**. The button member **270** of the retaining mechanism **230** is accessible through a first opening **207** (FIG. **11**) in an outer sleeve **206** of the adapter assembly **200**. The sliding button member **296** is accessible through a second opening **207***b* (FIG. **12**) in the outer sleeve **206**.

FIGS. **14** and **15** illustrate the lower retaining block extension **290** of the retaining mechanism **230** which includes a substantially rectangular frame **292** defining an opening **291** for receiving the sliding button member **296**. A pair of cutouts **293** in the frame **292** support a pair of stop members **298***a* of the sliding button member **296**. The lower retaining block extension **290** is received within the outer sleeve **206** (FIG. **16**) of the adapter assembly in engagement with the retaining block **240** and opposite the upper retaining block extension **260**.

The sliding button member **296** of the retaining mechanism **290** includes a body portion **298** configured for operable engagement by a user, and the pair of stop members **298***a* extending outwardly from the body portion **298**. The stop members **298***a* ride within the cutouts **293** of the lower retaining block extension **290**. The sliding button member **296** is moveable between a first or distal position (FIG. **13**) in which the stop members **298***a* of the sliding button member **296** are aligned with free ends **258***a*, **258***b* (FIG. **16**) of legs **254***a*, **254***b*, respectively, of the cam wire **250** and a second or proximal position (FIG. **17**) in which the stop

members **298***a* are spaced from the free ends **258***a*, **258***b* of the legs **254***a*, **254***b*, respectively, of the cam wire **250**.

A cylindrical recess **297** (FIG. **15**) in an end of the sliding button member **296** of the retaining assembly **230** is configured to receive a biasing member, e.g., a coil spring **299** (FIG. **14**) for biasing the sliding button member **296** in a first direction, e.g., distally, as shown, to the distal position. The sliding button member **296** is accessible through the second opening **207***b* (FIG. **12**) in the outer sleeve **206** of the adapter assembly **200**.

FIG. **16** illustrates the retaining mechanism **230** in a first or lock position with the cam wire **250** in a first position and the sliding button member **296** in the distal position. The sliding button member **296** is maintained in the distal position by the coil spring **299**. As described above, when the sliding button member **296** of the retaining mechanism **230** is in the proximal position, the stop members **298***a* of the sliding button member **298** are aligned with the free ends **258***a*, **258***b* of the legs **254***a*, **254***b*, respectively, of the cam wire **250** to prevent movement of the cam wire **250** to the second position.

FIGS. **17** and **18** illustrate the method for removal of the trocar assembly **230** from the adaptor assembly **200**. When the trocar assembly **230** is removed from the distal portion **204** of the adapter assembly **200**, the sliding button member **296** is moved proximally, against the bias of the coil spring **299**, as indicated by arrows "E". Proximal movement of the sliding button member **296** moves the stop members **298***a* of the sliding button member **296** out of engagement with the free ends **258***a*, **258***b* (FIG. **16**) of the legs **254***a*, **254***b*, respectively, of the cam wire **250**. With the stop members **298***a* of the sliding button member **296** no longer preventing movement of the cam wire **250** to the second position, the button member **270** may be depressed, as indicated by arrow "F" to cause the cam wire **250** to move to the second position, as indicated by arrows "G". As discussed in detail above with respect to retaining mechanism **130**, as the cam wire **250** moves to the second position, the retaining members **280***a*, **280***b* (FIG. **16**) move radially outward from within first and second locking openings **223***a*, **223***b* of a trocar housing **232** of the trocar assembly **230** to release the trocar assembly **230** from within the distal portion **204** of the adapter assembly **200**, and permit removal of the trocar assembly **230** from within the adapter assembly **200**.

FIGS. **19-25** illustrate a release mechanism according to another exemplary embodiment of the disclosure. The release mechanism is shown generally as collar assembly **390**. The collar assembly **390** is configured to depress a button member **370** of a trocar retaining mechanism **320**. More particularly, collar assembly **390** includes an annular member **392** receivable about a distal portion **304** of an adapter assembly **300**. The annular member **392** includes a cam lug **394** extending from an inner surface of the annular member **392** and having an inclined surface **394**. The cam lug **394** is configured to engage and depress the button member **370** during proximal movement of the collar assembly **390** relative to the outer sleeve **306** of the adapter assembly **300**.

The annular member **392** defines a pair of flush ports **391** (FIG. **21**), and a slot **393** for receiving a pin **307** extending from an outer sleeve **306** of the adapter assembly **300**. The flush ports **391** align with a flush port **305** on the outer sleeve **306** of the adapter assembly **300**. The pin **307** limits travel of the collar assembly **390** relative to the adapter assembly **300**.

With particular reference to FIG. **22**, the collar assembly **390** is shown in a first or distal position. In the distal position, the cam lug **394** is spaced from the button member **370**. In this manner, the button member **370** is in a first or undepressed position. When the collar assembly **390** is in the distal position, the annular member **392** covers the button member **370** to prevent accidental depression of the button member **370**. In embodiments, the collar assembly **390** may be maintained in the distal position by a biasing member, e.g., coil spring **399** (FIG. **24**), received about the outer sleeve **306** of the adapter assembly **300** proximal of the collar assembly **390**. It is envisioned that the collar assembly **390** may be biased distally using a pneumatic cylinder, or in any other suitable manner.

FIG. **23** illustrates the collar assembly **390** as it is moved proximally as indicated by arrows "H". When the collar assembly **390** is moved proximally, as indicated by arrows "H", the inclined surface **394***a* of the cam lug **394** of the collar assembly **390** engages the button member **370**, causing the button member **370** to be depressed, as indicated by arrow "I". As the button member **370** is depressed, the cam wire **350** is moved to a second position to cause the release of trocar assembly **320** as described above with reference to retaining mechanism **130** and trocar assembly **120**. As noted above, the pin **307** (FIG. **24**) extending from the outer sleeve **306** of the adapter assembly **300** limits travel of the collar assembly **390**.

With reference to FIG. **25**, in an alternative embodiment, a collar assembly **490** is configured to be rotated relative to the outer sleeve **406** of the adapter assembly **400** to effect depression of a button member **470** of the retaining assembly **430**. The collar assembly **490** includes an annular member **492** and a cam lug **494** extending from an inner surface of the annular member **492**. The cam lug **494** is configured to engage the button member **470** and defines a slot **493** for receiving a pin **407**. The pin **407** extends from the outer sleeve **406** for limiting movement of the collar assembly **490**.

During use, the collar assembly **490** is rotated about the outer sleeve **406** of the adapter assembly **400**, as indicated by arrow "J". When the cam lug **496** of the collar assembly **490** engages the button member **496**, the button member **496** is depressed, causing a wire cam **450** to move to a second or release position, thereby unlocking a trocar assembly **420** received within the adapter assembly **400**.

Persons skilled in the art will understand that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary embodiments. It is envisioned that the elements and features illustrated or described in connection with one exemplary embodiment may be combined with the elements and features of another without departing from the scope of the disclosure. As well, one skilled in the art will appreciate further features and advantages of the disclosure based on the above-described embodiments. Accordingly, the disclosure is not to be limited by what has been particularly shown and described.

What is claimed is:

1. An adapter assembly for connecting a loading unit to a handle assembly, the adapter assembly comprising:

an outer sleeve;

a trocar assembly releasably securable within the outer sleeve, the trocar assembly including a trocar housing defining first and second openings; and

a retaining mechanism configured to releasably secure the trocar assembly within the outer sleeve, the retaining mechanism including a retaining block, a cam wire moveably positioned relative to the retaining block between a lock position and a release position, a

retaining block extension configured to maintain the cam wire relative to the retaining block, a button member in operable engagement with the cam wire, and a pair of retaining members moveable from a first position received within the first and second openings of the trocar assembly when the cam wire is in the lock position and a second position spaced from the trocar assembly when the cam wire is in the release position, the retaining block extension including a stop tab, wherein the button member includes a center beam moveable from an unflexed position in engagement with the stop tab of the retaining block extension to prevent movement of the button member to a flexed position out of alignment with the stop tab to permit movement of the button member.

2. The adapter assembly of claim **1**, wherein the button member is pivotable relative to the retaining block from a non-depressed position when the center beam is in the unflexed position and a depressed position when the center beam is in the flexed position.

3. The adapter assembly of claim **2**, wherein depression of the button member causes the cam wire to move from the lock position to the release position.

4. The adapter assembly of claim **2**, wherein the center beam includes a rib configured for operable engagement by a user.

5. The adapter assembly of claim **2**, wherein the button member defines a relief on either side of the center beam to permit movement of the center beam between the unflexed and flexed positions.

6. The adapter assembly of claim **2**, wherein the button member defines a midline, the stop tab being aligned with the midline.

7. The adapter assembly of claim **6**, wherein the center beam is aligned with the midline when in the unflexed position and is misaligned with the midline when in the flexed position.

8. The adapter assembly of claim **1**, wherein the retaining block defines a central opening for receiving the trocar assembly.

9. The adapter assembly of claim **1**, wherein each retaining member of the pair of retaining members include a wedge-shaped free end.

10. The adapter assembly of claim **1**, wherein the retaining block defines a central opening for receiving the trocar assembly.

11. An adapter assembly for connecting a loading unit to a handle assembly, the adapter assembly comprising:

an outer sleeve; and

a retaining mechanism configured to releasably secure a trocar assembly within the outer sleeve, the retaining mechanism including a retaining block defining a longitudinal passage for receipt of the trocar assembly, a cam wire moveably positioned relative to the retaining block between a lock position and a release position, a retaining block extension configured to maintain the cam wire relative to the retaining block, a button member in operable engagement with the cam wire, and at least one retaining member moveable from a first position extending into the longitudinal passage when the cam wire is in the lock position and a second position clear of the longitudinal passage when the cam wire is in the release position, the retaining block extension including a stop member, wherein the button member includes a flexible portion moveable from an unflexed position in engagement with the stop member of the retaining block extension to prevent movement of the button member to a flexed position out of alignment with the stop member to permit movement of the button member.

12. The adapter assembly of claim **11**, wherein the button member is pivotable relative to the retaining block from a non-depressed position when the flexible portion is in the unflexed position to a depressed position when the center beam is in the flexed position.

13. The adapter assembly of claim **12**, wherein depression of the button member causes the cam wire to move from the lock position to the release position.

14. The adapter assembly of claim **12**, wherein the flexible portion includes a rib configured for operable engagement by a user.

15. The adapter assembly of claim **12**, wherein the button member defines a relief on either side of the flexible portion to permit movement of the flexible portion between the unflexed and flexed positions.

16. The adapter assembly of claim **12**, wherein the button member defines a midline, the stop member being aligned with the midline.

17. The adapter assembly of claim **16**, wherein the flexible portion is aligned with the midline when in the unflexed position and the flexible portion is misaligned with the midline when in the flexed position.

18. The adapter assembly of claim **11**, wherein the retaining block defines a central opening for receiving the trocar assembly.

19. The adapter assembly of claim **11**, wherein each retaining member of the pair of retaining members include a wedge-shaped free end.

20. An adapter assembly for connecting a loading unit to a handle assembly, the adapter assembly comprising:

an outer sleeve; and

a retaining mechanism configured to releasably secure a trocar assembly within the outer sleeve, the retaining mechanism including a retaining block, a cam wire moveably positioned relative to the retaining block between a lock position and a release position, a retaining block extension configured to maintain the cam wire relative to the retaining block, a button member in operable engagement with the cam wire, and a pair of retaining members moveable from a first position engageable with the trocar assembly when the trocar assembly is received within the outer sleeve and the cam wire is in the lock position, and a second position spaced from the trocar assembly when the trocar assembly is received within the sleeve and the cam wire is in the release position, the retaining block extension including a stop member, wherein the button member includes a center beam moveable from an unflexed position in engagement with the stop member of the retaining block extension to prevent movement of the button member to a flexed position out of alignment with the stop member to permit movement of the button member.

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